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Illustrated Handbook of Succulent Plants

Series Editors: U. Eggli, H. E. K. Hartmann

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Illustrated Handbook of Succulent Plants

(Eggli/Hartmann Eds.)

Illustrated Handbook of Succulent Plants: Monocotyledons
Ed. by Urs Eggli (2001)

Illustrated Handbook of Succulent Plants: Dicotyledons
Ed. by Urs Eggli (2002)

Illustrated Handbook of Succulent Plants: Aizoaceae A–E
Ed. by H. E. K. Hartmann (2001)

Illustrated Handbook of Succulent Plants: Aizoaceae F–Z
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Illustrated Handbook of Succulent Plants: Asclepiadaceae
Ed. by F. Albers and U. Meve (2002)

Illustrated Handbook of Succulent Plants: Crassulaceae
Ed. by Urs Eggli (2003)

Urs Eggli (Ed.)

Illustrated Handbook of Succulent Plants: Crassulaceae

With 341 Colour Photos, Printed in 48 Colour Plates



Springer

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Preface

The present volume covering the *Crassulaceae* marks the completion of the successful handbook series that presents a complete coverage of the so-called "other" succulents, i.e. of all taxa of succulent plants with the exception of the *Cactaceae*.

It is with pride that this volume is now put before the public. Together with its predecessors, it is the fruit of a truly international project. Not only does the present volume constitute the first complete synopsis of the large and horticulturally important family *Crassulaceae* published since the treatment by Berger (1930), but the handbook series as a whole is a landmark in succulent plant literature.

The history of the project that eventually led to the publication of the present handbook series was outlined in the Preface to the Monocotyledons Volume, published in the summer of 2001. A short summary of its history will therefore suffice.

Handbooks devoted to succulent plants (including cacti) have a long-standing tradition. First treatments covering the family *Cactaceae* were already published in the 19th century, but the first handbook dealing with the so-called "other succulents", authored by Hermann Jacobsen, was only published in 1954 - 1955, then called "Handbuch der sukkulenten Pflanzen". A revised and enlarged English edition was published in 1959 and was repeatedly reprinted subsequently.

The success of this first handbook led to the publication of the more compact "Sukkulentenlexikon", again authored by Hermann Jacobsen, published in 1970 in a German edition and in 1975 in an English translation. Subsequent to Hermann Jacobsen's death in August 1978, Klaus Hesselbarth edited the revised German edition, published in 1981.

First ideas leading to the present "Illustrated Handbook" were developed prior to the 1990 Congress of the International Organization for Succulent Plant Study (IOS) in Zürich. The feeling amongst participants of an ad-hoc meeting during this congress was that the plan for revised editions of both the "Sukkulentenlexikon" and the "Kakteenlexikon" presented a unique occasion to produce a set of authoritative volumes embracing *all* succulent plants.

The initial project planned a set of 3 volumes, devoted to *Cactaceae*, *Aizoaceae*, and the "remaining succulents", respectively. It soon became apparent, however, that a single volume would not be sufficient to cover the vast array of these "remaining succulents", and they now embrace 4 of the 6 volumes that constitute this series of illustrated handbooks. The other 2 volumes, devoted to the *Aizoaceae* and edited by Heidrun E. K. Hartmann, were published in the second half of 2001. A similar handbook covering the *Cactaceae* is not ready currently for inclusion in this series of handbooks.

In comparison with Hermann Jacobsen's "Sukkulentenlexikon", the present handbooks have many additional features. The descriptions present much greater details and are as diagnostic as possible. There are literature references and typification data for all accepted taxa when available, and full synonymies. Published illustrations are cited for many of the accepted taxa that are not illustrated in the handbooks, and the etymology of the generic names is explained.

The production of the present volume on *Crassulaceae* was overshadowed by the death of our colleague Henk 't Hart (24.7.1944 - 22.7.2000). Henk was a *Crassulaceae* specialist of many years standing, and his scientific work concentrated on this family. His research, as well as projects carried out under his guidance, added significantly to our knowledge of the relationships within the family. Henk was also an important contributor to the present volume. His untimely death did not permit him to complete all the texts that he had envisaged, but the firm base and the framework that he provided allowed the completion of the missing parts. The present volume is dedicated to his memory with a feeling of gratitude for his important contributions.

Acknowledgments

As for the previous volumes, a special word of thanks goes to all the contributors to this book. Without their help and enduring patience, the compilation and editing of this handbook would not have been the pleasure that it was.

It is also my pleasure to thank the publishing houses of Springer-Verlag, Heidelberg (for the English edition) and Ulmer-Verlag, Stuttgart (for the concurrent German edition), who provided a platform for the publication of these handbooks.

The compilation of the volumes treating the "remaining succulents" was undertaken using computing infrastructure provided by the Municipal Succulent Plant Collection Zürich (ZSS), and the permission to do so is gratefully acknowledged. Thanks are extended to both to its former director, Diedrich J. Supthut, as well as to the present director, Dr. Thomas Bolliger, and to the authorities of the City Parks Department.

Numerous individuals helped during the compilation and editing process. A word of thanks is not only due to all my colleagues who contributed texts to the project, but also to all those who acted more in the background. Numerous friends supplied literature references or made other data available. A very important role was also played by the innumerable growers of succulent plants worldwide and the many societies devoted to the study and cultivation of these fascinating plants. Their efforts significantly add to our knowledge, and the handbook series relied heavily on this data.

Finally, I would like to thank my family, wife and son, as well as all my colleagues at ZSS and elsewhere for their patience when the handbooks kept me busy. A special word of thanks is due to Dr. Johanna Schlüter of the now defunct Gustav Fischer Verlag Jena, who so ably accompanied this project during the first three quarters of its long history. A further word of thanks goes to Dr. Dieter Czeschlik and Dr. Jutta Lindenborn from Springer-Verlag, for their help in making this handbook become a reality.

Zürich, November 2002

U. EGGLI

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Note: ♦ = family or genus completely covered; ◇ = family or genus only partially covered;
 ~ = family or genus only mentioned; numbers in brackets = numbers of species / infraspecific
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List of Abbreviations and Symbols

Ø	diameter	Gl	gland
±	more or less, circa	Gr.	Greek
>	greater than	Gy	gynostegium
≥	greater or equal than	Ha	hair(s)
<	less than	Herb. / herb.	herbarium
≤	less or equal than	holo	holotype
×	hybrid indicator	Hort. / hort.	of gardens
		I	illustration
Anth	anthers	ICBN	International Code of Botanical Nomenclature, Tokyo Edition
Ar	areole	illeg.	illegitimate
Art.	article (of ICBN)	in sched.	"in schedis", i.e. in the herbarium
Ax	axil	incl.	including
BG	Botanical Garden	Inf	inflorescence
Bo	body	ING	Index Nominorum Genericorum
BPH	Botanico-Periodicorum-Huntianum (1968)	Int	internode
BPH/S	idem., Supplementum (1991)	inval.	invalid
Br	branch	ITep	inner tepals
Bra	bract	KG, KGW	Karoo Garden (Worcester, RSA)
Bri	bristles	l.c.	"loco citato", i.e. at the place cited
C	central	L	leaf, leaves
Ca	carpels	lecto	lectotype
Cal	calyx	Lit	literature
Cap	capitulum	ms.	manuscript
Ci	interstaminal corona	Mt. / Mts.	Mount / Mountains
Cl	corolla	N	North, northern
Cn	corona	NBG	National Botanical Garden (RSA)
Cs	staminal corona	NE	North-East, north-eastern
cv.	cultivar	Nec	nectary
Cy	cyathium	neo	neotype
D	distribution	NGl	nectar gland
E	East, eastern	nom.	"nomen", i.e. botanical name
e.g.	for example	NSc	nectar scale
epi	epitype	NW	North-West, north-western
esp.	especially	OTep	outer tepals
Etym	Etymology	Ov	ovary
excl.	excluding	p.	page
f.	figure	p.a.	"per annum", i.e. per year
fa.	forma	p.p.	"pro parte", i.e. partly
fig.	figure		
Fil	filaments		
Fl	flower		
fl.	"floruit", i.e. living		
Fr	fruit		

Pc	pericarpel
Ped	pedicel
Per	perianth
pers. comm.	personal comment
Pet	petals
Phy	phyllaries
pl.	plate
Poll	pollinia
pp.	pages
R	roots
Rec	receptacle
Ri	ribs
Ros	rosette
RSA	Republic of South Africa
S	South, southern
s.a.	"sine anno", i.e. without year
s.l.	"sensu lato", i.e. in a wide sense
s.n.	"sine numero", i.e. without (collection) number
s.str.	"sensu stricto", i.e. in a strict sense
Sc	scale
SE	South-East, south-eastern
Se	seeds
Sect.	section
SEM	Scanning Electron Micrograph
Sep	sepals
Ser.	series
Sp	spines
SpS	spine shield
ssp.	subspecies
St	stamens
Sti	stigma
Sty	style
Subgen.	subgenus
Subsect.	subsection
Subser.	subseries
SUG	Stellenbosch University Gardens (RSA)
SW	South-West, south-western
syn	syntype
T	(nomenclatural) type
t.	plate
Tep	tepals
TL2	Taxonomic Literature, ed. 2 (1976-2000)
tt.	plates
Tu	tubercles
unpubl.	unpublished
USA	United States of America
var.	variety
W	West, western

Abbreviations for frequently cited publications

BJS	Botanische Jahrbücher für Systematik
BMI	Bulletin of Miscellaneous Information [Kew]
BT	Bothalia
CBM	Curtis's Botanical Magazine
CSJA	Cactus and Succulent Journal (US)
CUSNH	Contributions of the US National Herbarium
EJ	Euphorbia Journal
FC	Flora Capensis (ed. Harvey & al., 1860 - 1925)
FPA	Flowering Plants of Africa
FPsA	Flowering Plants of South Africa
FTA	Flora of Tropical Africa (ed. Oliver & al., 1868 - 1937)
HIP	Hooker's Icones Plantarum
JLSB	Journal of the Linnean Society, Botany
JSAB	Journal of South African Botany
KB	Kew Bulletin
KuaS	Kakteen und andere Sukkulente
NPF2	Die natürlichen Pflanzenfamilien Ed. 2 (ed. Engler & Prantl, 1924 - 1959)
PSRV	Prodromus Systematis Naturalis Regni Vegetabilis (De Candolle, 1824 - 1873)
RSN	Repertorium Specierum Novarum Regni Vegetabilis
SAJB	South African Journal of Botany
WDSE	Succulent Euphorbieae (South Africa) (White & al., 1941)

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Introduction

What is a succulent ?

It is probably impossible to define what constitutes a *succulent plant* – at least in view of the several competing definitions. For the purpose of this handbook, a pragmatic approach has been selected, and apart from the multitude of unambiguous succulents, many borderline cases are included as well, especially if the species in question are encountered in cultivation together with other succulents, and if they are native to more or less semi-arid regions and consequently show some degree of xerophytic adaptation. This, then, includes most of the caudex and pachycaul plants now popular in cultivation.

Other borderline cases included are a number of bulbous and rhizomatous monocotyledons, where examples from several genera are covered, as well as several weakly developed leaf succulents from the *Gesneriaceae* (e.g. *Columnnea*).

On the other hand, purely halophytic succulents (such as *Salicornia*) are omitted from these pages since they are as a whole neither adapted to climatically dry conditions nor encountered in collections devoted to succulent plants.

Finally, some families with undoubted claim to (xerophytic) succulence have been excluded from this set of volumes. This notably is the case for the *Cactaceae*, which will be treated elsewhere. In addition, the families *Bromeliaceae* and *Orchidaceae* are also excluded. Both count with a considerable number of mostly leaf succulents, but for both, vast specialist literature and numerous specialist societies are in existence, and this effort does not need to be duplicated here. For all these excluded families, however, a family description is included in the present volumes for the sake of completeness.

How to use this handbook

Since all information is presented in strictly alphabetical sequence of families, genera and species (except that monocotyledons and dicotyledons are treated separately, and that the families *Aizoaceae*, *Asclepiadaceae* and *Crassulaceae* occupy their own volumes), it is easy to find the entry for a given species as long as its family placement is known.

An alternative way is to use the taxonomic cross-reference index supplied at the end of the

volume. This index contains all the names treated in the volume and for accepted names indicates the page where a treatment can be found, or in the case of synonyms gives the name of the accepted taxon and a page reference as above. For names merely mentioned in the text, the index gives the page reference and the name under which information can be found.

If a completely unknown plant is to be identified, the handbook supplies keys to the genera with succulent representatives for each family. Please note that these keys are designed to work for the succulent taxa treated, and do not necessarily include the total variation encountered in a genus. If the family is not known, the reader is referred to general botanical books that include keys to plant families. Rowley (1980) and Eggli (1994) provided keys for flowering and non-flowering succulents, and Geesink & al. (1981) produced a well-known book of keys to all flowering plants worldwide.

Scope of information presented

Families

The family names adopted are always conforming to the standard form (ending in *-aceae*); alternative names (such as *Compositae* for *Asteraceae*) are not used.

Within each family, the genera are treated in alphabetical sequence, and the same applies to the sequence of species within genera. Some genera of minimal importance or with borderline succulence are only mentioned or at the most described, but no individual species are treated.

The following families are included as a whole, i.e. with all their component species: *Agavaceae*, *Aloaceae* and *Doryanthaceae* in the present volume covering the Monocotyledons, and the *Didiereaceae*, *Fouquieriaceae* and *Nolanaceae* in the Dicotyledons volume. The *Aizoaceae* and *Crassulaceae* are covered in their entirety in separate volumes within this series, and the succulent taxa of the *Asclepiadaceae* likewise occupy a separate volume of the Handbook.

The family description characterizes the family as a whole, which often includes much more variation than that observed amongst its succulent representatives.

This is followed by notes on the distribution, classification and economic importance of the family, and the occurrence of succulence if this is not a general feature of the family as a whole. Also, a key to genera with succulents is included, and special terminology used for genera and species descriptions is discussed.

The family concept adopted more or less follows Mabberley (1987), except for the monocotyledons, where Dahlgren & al. (1985) is used as a base, with a number of small modifications.

Genera and species

The entries for genera and species follow the same layout. Names of authors are given in full, with initials added where necessary according to Brummitt & Powell (1992). The literature reference of the original description or combination is followed by information on typification (where available, see below). In the case of genera, important literature is then cited. This is followed by information on geographical distribution (including notes on ecology where available) and an explanation of the etymology for generic names.

The main part of the entry is made up by the diagnostic description of the taxon, followed by a discussion of its variability, circumscription and/or application where necessary. It should be noted that these descriptions reflect major variability only, but do not include all the reported minor variations.

For larger genera, an outline of the accepted formal or informal classification is also given, with individual taxa or groups numbered in sequence. These sequence numbers are then given at the start of each taxon description to indicate its placement within the genus.

If recent conflicting classifications are available for a given group, this is shortly discussed and the classification adopted is indicated.

Minor spelling variants of epithets are not indicated; instead, the 'corrected' spelling is used throughout for accepted names and synonyms.

Infraspecific taxa

Infraspecific taxa are given in strict alphabetic order of rank and name (i.e. ranks in the sequence cv., fa., ssp., var.). This is due to the strict alphabetical sorting used when the output for the handbook was generated from a computerized database. It also means that the typical infraspecific taxon (i.e. the one repeating the species name) is not treated first as in many handbooks, but in its appropriate alphabetical sequence.

Cultivars, hybrids

Cultivars (rank abbreviated as cv.) are not included on an exhaustive base. Cultivars not associated

with a species are enumerated first, i.e. between the generic entry and the first species. Cultivars associated with a species name are included under that species, either as an entry of their own (and in the same form as subspecies etc.), or, in the case of cultivars of minor importance, in the form of a short mention in the species discussion. Cultivar nomenclature follows the guidelines of the ICBN.

Formally named hybrid genera are either included as 'genera' of their own, or dealt with in the discussion of their parent genera. The same applies to formally named hybrid species (incl. those named as cultivars). Hybrids only known with their hybrid formula are either discussed in the generic entry, or mentioned under one or the other of their parent species. No attempt has been made, however, to include all the numerous formally named hybrids.

Descriptions

The descriptions are as compact, concise and diagnostic as possible. Characters that do not vary for the group concerned are not repeated from the family or genus descriptions. In the case of genera further subdivided, information already presented in the group definitions is also not normally repeated in the descriptions of individual taxa.

Measurements

All measurements are given in metric units. Measurements without further qualifications *always refer to the long axis* of the organ described (i.e. length, height etc.); two measurements united with the $\times$ -sign stand for length $\times$ width.

Terminology

Special terms used in descriptions are explained when first used; other botanical terminology is not further explained, and the readers are referred to the numerous botanical glossaries, of which Stearn (1992) is cited by way of a most important and useful example.

Typification

This information is included for convenience when readily available, but is lacking in numerous cases. The type citations include the country and major administrative unit where the type was collected, the collector and collection number, and the herbaria where material is said or known to be deposited. The herbarium acronyms conform to *Index Herbariorum*, Ed. 8 (Holmgren & al. 1990). Where more than one herbarium acronym is given, the first relates to the holotype, the others to isotypes. Additional information on typification is sometimes added, especially in the case of lecto- or neotypes.

Nomenclatural status of names

For all taxa treated, every attempt has been made to use only valid and legitimate names, but this was not achievable in a small number of cases. In the synonym lists, the nomenclatural status (invalid, illegitimate, rejected) is indicated by citing the ICBN articles violated (following the numbering in the "Tokyo" Code). Spelling variants are considered as invalidly published according to ICBN Art. 61.

Synonymies

The synonymies given for genera and especially species are as exhaustive as possible and include all names recognized as synonyms. The first synonym(s) – if applicable – is/are the basionym and/or later combination(s) for the accepted name of the entry. All combinations of the same basionym are given in sequence of publication and are united with the $\equiv$ -sign to indicate that these are homotypic (nomenclatural) synonyms. Please note that the $\equiv$ -sign is only used for *combinations* based on the same basionym and does not indicate other homotypic synonyms (e.g. *nomina nova*). All other synonyms are headed with 'incl.' to indicate that they are, with the exception of *nomina nova* based on the same type, taxonomic synonyms (= heterotypic synonyms). Again, groups of combinations based on the same basionym are united with $\equiv$ -signs. Basionyms are given first and in chronological order.

Geographical names

Country names are listed roughly in a North to South and West to East sequence. Every attempt has been made to standardize geographical names (of countries, administrative units, regions, etc.) as far as possible, but there is a surprising amount of change relating to such names. This is specifically the case for the names of the RSA provinces, which have changed considerably during 1995, especially affecting the former Cape Province, which has been split up into 4 units (North-West Province, Northern Cape, Western Cape, Eastern Cape). We have tried as best as we could to provide the modern names in the distribution information included in the handbook, but it has been impossible to adjust all the data for type localities, where the name "Cape Prov." is still used in some cases. This results in some inconsistencies, but it is hoped that these are tolerable under the present circumstances.

Some difficulties were also encountered in a few cases where countries have been amalgamated (as in the case of the former North Yemen and South Yemen) or divided (e.g. Eritrea, formerly

part of Ethiopia). Full consistency in all these cases cannot be guaranteed.

In order to save space, geographical directions such as North, South, etc., are *always* abbreviated (N, S, etc.). Please note that *SW Africa* indicates 'southwestern Africa' and *not* the former Southwest-Africa (now Namibia). Similarly, *S Africa* indicates 'southern Africa' and *not* the Republic of South Africa, for which the abbreviation RSA is always used.

Literature references

Literature references are given for all accepted names. Normally, the publication is cited with a full abbreviation according to the standards defined in Eggli (1985) and Eggli (1998) for specialist succulent plant periodicals, or BPH (Lawrence & al. 1968) and BPH/S (Bridson & Smith 1991) for other periodicals, while TL2 of Stafleu & Cowan (1976-1988) and supplements (Stafleu & Mennega 1992-2000) are followed for book abbreviations (in both causes with some minor exceptions to conserve uniformity).

A number of frequently used titles of journals and books are further abbreviated to a short acronym, and a list of these acronyms follows the list of Abbreviations and symbols (page XI).

In the running text, literature is cited in the usual way (author and year, sometimes supplemented by a page reference), and full details can be found in the list of references at the end of the volume.

Illustrations

An attempt has been made to cite one readily accessible illustration for each species or infraspecific taxon when no illustrations are included in the literature reference for the accepted name. If the name used in the cited publication differs from the accepted name in the handbook, it is indicated (genus name abbreviated to first letter if identical, specific or infraspecific epithet omitted if identical to the accepted name).

Illustrations in the illustration section of this volume are given in bold print to distinguish them from other material cited.

Indication of authorships

For families, authorship is indicated at the end of the entry. For genera, authorship is given as a subheading after the genus heading. If more than one author has contributed species entries for a genus, each entry has its own indication of authorship as far as its authorship differs from the authorship given for the genus as a whole. It is thus possible to identify the author(s) of any entry in the handbook.

Crassulaceae

Perennial or rarely annual or hapaxanthic herbs, subshrubs to shrubs (rarely aquatics, or tree-like, or epiphytic, or scandent), usually with succulent **L**, sometimes with succulent stems or underground caudices; **L** opposite and decussate or alternate and spiral, frequently aggregated into **Ros**, simple, usually entire, or crenate to lobed, glabrous or tomentose; stipules absent; **Inf** lateral or terminal many-flowered spikes or panicles, rarely few- to 1-flowered and axillary; **Fl** bisexual or unisexual (then plants $\pm$ dioecious), actinomorphic (except *Tylecodon grandiflorus*), frequently 5-merous but varying from 3- to 32-merous; **Sep** free or basally united; **Pet** free or basally united to form a short to long **Cl** tube; **St** as many or $2\times$ as many as **Pet**, free or fused to them; **Ca** as many as **Pet**, superior, free or almost so, basally with a small to conspicuous **NSc**, gradually tapering into short to long **Sty**, with few to many ovules; **Fr** usually dehiscent follicles, capsular; **Se** smallish, to 1.5 - 3 mm, elongate, smooth, papillate to longitudinally ridged, mostly brownish.

Distribution: Worldwide but esp. N hemisphere and S Africa.

Literature: Berger (1930); 't Hart (1995); Eggli & al. (1995).

The family counts $\pm$ 1400 species in 33 genera here accepted. It is here treated in its entirety, adopting the consensus classification proposed by Eggli & al. (1995), but modified to accept the additional genera *Afrovivella*, *Phedimus* and *Prometheum*, and subsuming *Bryophyllum* under *Kalanchoe*, and *Jovibarba* under *Sempervivum*. The family has no important crop plants, with the exception of numerous taxa of horticultural interest, mainly as hardy perennials for rock gardens, and – more recently – for establishing green ‘living’ roofs. *Hylotelephium spectabile* is sometimes used in the cut-flower trade. Numerous species from almost all genera are popular in succulent plant collections.

Due to numerous suspected parallel developments, the classification of the family has been difficult, and the identification of species is often problematical because of hybridization (to a limited extent natural, and almost without limits in cultivation, esp. amongst genera in Group F). The traditional circumscription of 6 subfamilies by Berger (1930) was known to be artificial for some time. Recently, a revised classification was proposed by 't Hart (1995), based on molecular and morphological data:

Subfamily **Crassuloideae** A. Berger 1930: **Fl** haplostemonous (**St** as many as **Pet**): *Crassula*

Subfamily **Sedoideae** A. Berger 1930: **Fl** obdiplostemonous (**St** $2\times$ as many as **Pet**) (with few exceptions):

– Tribe **Kalanchoeae** 't Hart 1995: **L** decussate or alternate, flat (rarely terete), crenate or dentate (rarely entire); **Fl** 4- or 5-merous; **Pet** united to form a distinct tube; **Se** costate:

Group A: **L** alternate: *Adromischus*, *Tylecodon*.

Group B: **L** decussate: *Cotyledon*, *Kalanchoe*.

– Tribe **Sedeae** 't Hart 1995: **L** mostly alternate, thick, entire (if decussate **Pet** free and **Se** costate); **Fl** (3- to) 5- to 32-merous; **Se** costate, (multi-) papillate or reticulate:

- Subtribe *Telephinae* 't Hart 1995: Stems often basally woody, tuberous or sympodial or monopodial rhizomes; **L** usually alternate, flat, dentate or crenate (rarely decussate, terete or entire); **Fl** 5-merous (if polymorous then **L** flat, opposite or whorled); **Sep** basally connate; **Pet** usually free (if connate then **Se** multipapillate); **Se** costate or multipapillate: *Hylotelephium*, *Hyphagophytum*, *Orostachys*, *Perrierosedum*, *Phedimus*, *Pseudosedum*, *Rhodiola*, *Umbilicus*.

- Subtribe *Sedinae* 't Hart 1995: Stems herbaceous, rarely woody or rhizomatous; **L** often rosulate or subrosulate, terete or semiterete, or flat and/or dentate-serrate and/or decussate; **Fl** 4- or to 32-merous; **Sep** basally connate or free; **Pet** usually free and stellately patent, rarely united; **Se** reticulate, papillate or costate:

Group C: Plants various; **L** in **Ros** or scattered, glabrous or glandular-hairy; **Inf** terminal or lateral: *Pistorinia*, *Prometheum*, *Rosularia*, *Sedum*.

Group D: Plants rosulate, from Europe, W Asia, the Caucasus or Macaronesia, mostly glandular-hairy; **Inf** mostly terminal; **Fl** mostly $>$ 5-merous: *Aeonium*, *Aichryson*, *Monanthes*, *Sempervivum*.

Group E: N American rosulate plants, glabrous but often farinose; **Inf** lateral; **Fl** 5-merous: *Dudleya*.

Group F: American plants, mostly with well-defined **Ros**, hairy or glabrous; **Inf** lateral or rarely terminal; **Fl** mostly 5-merous: *Echeveria*, *Graptopetalum*, *Lenophyllum*, *Pachyphytum*, *Thompsonella*, *Villadia*.

Key to the genera:

- 1 **Fl** with **St** as many as **Pet** (haplostemonous): 2
- **Fl** with **St** $2\times$ as many as **Pet** (obdiplostemonous): 8
- 2 **Fl** often (2- to) 4-merous or more rarely 10- to 12-merous (predominantly in Africa; extra-African taxa dwarf minute ephemeral herbs with 2- to 4-merous **Fl**): 3
- **Fl** usually 5-merous (outside Africa): 4

- 3 Perennial herbs with underground tuber or tuberous rhizome; stems deciduous; **L** ternate; **Fl** 10- to 12-merous; **Ca** 2-seeded, follicles opening transversally (Ethiopia): **Hypagophytum**
 – Not as above; **Ca** with > 2 **Se**, follicles opening apically: **Crassula**
- 4 Plants with persistent or monocarpic, dense to lax **Ros**: 5
 – Plants annual or perennial herbs without obvious **Ros**: 7
- 5 Monocarpic **Ros**-forming herbs (Europe and Asia): 6
 – Perennial shrublets with lax **Ros** at the stem tips (Mexico): **Graptopetalum pentandrum**
- 6 **Inf** flat-topped (corymbose): **Sinocrassula**
 – **Inf** thyrsoide-elongate: **Orostachys** p.p.
- 7 Annual to perennial herbs; **Fr** many-seeded follicles opening along the ventral side (Europe and Asia): **Sedum** p.p. (e.g. *S. rubens*)
 – Annual minute ephemeral herbs; **Fr** indehiscent and nutlet-like, each follicle with a single seed (USA: California): **Sedella** p.p.
- 8 Perennial plants, stems perennating but with annually deciduous **L**, or stems annually deciduous: 9
 – Annual (to biennial) plants, or perennial plants with at least some perennating **L**: 14
- 9 Stems obviously succulent, perennating; **L** crowded at branch tips (S and SW Africa):
Tylecodon
 – Stems not succulent and regularly deciduous and plants perennating with underground root stocks or small caudex (mostly outside of Africa): 10
- 10 **L** usually distinctly peltate; **Inf** terminal racemes or panicles (Asia and E Africa):
Umbilicus p.p.
 – **L** flat, never peltate; **Inf** usually cymes or corymbs, $\pm$ flat-topped (outside of Africa): 11
- 11 Plants with tuberous caudex and annually deciduous stems; **L** alternate; **Fl** 4- to 6-merous, often unisexual (plants monoecious or dioecious): **Rhodiola**
 – Plants with or without thickened roots but never with a caudex; **L** opposite, alternate or rarely verticillate; **Fl** various but plants never dioecious: 12
- 12 **L** flat: 13
 – **L** terete-subulate: **Villadia** p.p.
- 13 **R** thickened, fusiform, and stems annually deciduous; or **R** fibrous and stems perennial, woody, forming dwarf shrublets: **Hylotelephium**
 – **R** fibrous; stems annually deciduous: **Phedimus**
- 14 Plants with perennial monocarpic **Ros**: 15
 – Plants annual (to biennial), or perennial but then not with monocarpic **Ros**: 21
- 15 **NSc** conspicuous, broader and more obvious than the insignificant **Pet** (Canary and Selvagen Islands): **Monanthes** p.p.
 – **NSc** inconspicuous, much narrower than the showy **Pet**: 16
- 16 **Fl** 5- (to rarely 6-) merous; **Inf** corymbose to much elongated and spike-like: 17
 – **Fl** 6- to 32-merous; **Inf** corymbose to dome-shaped, never much elongated: 20
- 17 **Inf** flat-topped, corymbose or cymose, few-flowered: 18
 – **Inf** elongate, many-flowered: 19
- 18 **Pet** 2.5 - 4 mm, ascending, white (E Asia):
Meterostachys
 – **Pet** > 4 mm, ascending to spreading, whitish, yellowish, red or pink (E Mediterranean, W Asia): **Prometheum**
- 19 **Br** of the **Inf** helicoid (Turkey, Iraq, Turkmenistan): **Rosularia elymaitica**
 – **Br** of the **Inf** never helicoid (C to E Asia):
Orostachys p.p.
- 20 **Ros** sessile, usually < 10 cm Ø; **Fl** 6- to 18-merous, often in shades of pink and purple, rarely white or yellow: **Sempervivum**
 – **Ros** sessile or often with a conspicuous and sometimes branched stem, often > 10 cm Ø; **Fl** (6- to) 10- to 32-merous, often in shades of yellow but also whitish, more rarely reddish:
- Aeonium**
 21 **L** decussate throughout the whole length of the stems: 23
 – **L** verticillate or alternate at least in the upper stem parts, or in **Ros**: 22
- 22 **L** verticillate (Africa):
Sedum p.p. (e.g. *S. epidendrum*)
 – **L** alternate at least in the upper stem parts, or in **Ros**: 30
- 23 Annual to biennial glabrous to glandular-hairy herbs to 15 cm; **Fl** (4- to) 5-merous, white, pink or purplish; **Pet** 4 - 5 mm (Mediterranean): 24
 – Perennial herbs (sometimes monocarpic), or shrubs or small trees, or lianas; **Fl** 4- to 6-merous; **Pet** > 5 mm, in various colours: 25
- 24 Annual glabrous herbs; **Inf** to 5 cm tall:
Phedimus stellatus
 – Annual to biennial glandular-hairy herbs; **Inf** to 60 cm tall: **Sedum** p.p. (e.g. *S. cepaea*)
- 25 **Fl** 4-merous; herbs (sometimes monocarpic) to shrubs or small trees, or lianas (Africa, Madagascar, Asia, neophytes world-wide): **Kalanchoe**
 – **Fl** 5- or 6-merous; shrublets or herbs: 26
- 26 **Fl** 5-merous, not white (Africa, Caucasus, N America): 28
 – **Fl** (5- to) 6-merous, erect, white: 27
- 27 Shrublets to 80 cm tall (Madagascar):
Perrierosedum
 – Dwarf herbs to 10 cm tall (Europe and N Africa): **Sedum** p.p. (e.g. *S. dasyphyllum*)

- 28 Herbs with creeping stems; **L** flat and rather thin-textured; **Inf** arching; **Fl** yellow, narrowly urceolate (Caucasus): **Umbilicus oppositifolius**
 – Not with this combination of characters: 29
- 29 Plants shrubby, often > 50 cm tall; **L** not easily detached; **Fl** conspicuous, campanulate, 2 - 3 cm long, **Pet** basally connate, in various shades of orange to red or rarely yellowish (Africa, Arabia): **Cotyledon**
 – Herbs, 10 - 30 (-50) cm tall; **L** often easily detached; **Fl** small, to 1 cm long, yellow or yellowish; **Pet** free to the base (USA, Mexico): **Lenophyllum**
- 30 Perennial plants with sessile **Ros**, or shrubby with lax **Ros** at the stem tips or **L** scattered along the length of the stems, or stems short with short internodes and few crowded **L**: 31
 – Annual (to biennial) plants, or perennial plants, neither with conspicuous **Ros** nor shrubby: 46
- 31 **NSc** conspicuous and more obvious than the insignificant **Pet**: 32
 – **NSc** inconspicuous, much smaller than the showy **Pet**: 33
- 32 **Fl** (5- to) 6- to 9-merous (Canary Islands): **Monanthes** p.p.
 – **Fl** 5-merous (Mexico): **Sedum longipes**
- 33 Plants shrubby; **L** scattered along the length of the stems, never forming well-defined **Ros** (Americas): 34
 – Plants not shrubby, or if shrubby then stems with terminal **Ros**: 35
- 34 Stems slender to wiry and not distinctly succulent: **Villadia** p.p.
 – Stems distinctly succulent, with $\pm$ flaking papery bark: **Sedum** p.p. (e.g. *S. frutescens*)
- 35 **Ros** ill-defined, i.e. **L** crowded and stems with very short inconspicuous **Int**; **Inf** terminal spike-like thyrses; **Fl** 5-merous; **Sep** very short; **Cl** tubular (Africa): **Adromischus**
 – **Ros** $\pm$ well-defined; **Inf** lateral; **Fl** 5-merous (rarely 4- or 6- to 10-merous); **Sep** usually conspicuous; **Cl** tubular or stellate: 36
- 36 **Ros** to 5 cm $\varnothing$; **Fl** white or pale yellowish/reddish (Europe, W and E Asia): 37
 – **Ros** usually > 5 cm $\varnothing$: 38
- 37 **Fl** white (Europe, E Asia): **Meterostachys + Sedum** p.p.
 – **Fl** white or pale yellow/reddish (W Asia, E Mediterranean): **Prometheum** p.p.
- 38 Dwarf shrublets with glandular-hairy **L** in terminal **Ros**; **Fl** yellow, 7- to 8-merous (Canary Islands): **Aichryson** p.p.
 – Not with this combination of characters: 39
- 39 **Ros** stemless, offsetting with brittle runners; **L** margins conspicuously ciliate; **Fl** 5- to 7-merous, white tinged reddish (Ethiopia): **Afrovivella**
 – Not with this combination of characters: 40
- 40 **Ros** stemless; **Fl** 5- to 9-merous, $\pm$ cup-shaped to $\pm$ urceolate to saucer-shaped, white, whitish, pinkish or pink but never in bright colours, never long-tubular, not very fleshy: 41
 – Not with this combination of characters (America): 42
- 41 **Fl** 5-merous, white; **Pet** basally free or almost so (Mexico): **Sedum** p.p. (*S. suaveolens*)
 – **Fl** 5- to 9-merous, white to pinkish or pink, **Pet** basally united (E Mediterranean, Asia Minor to E Asia): **Rosularia** p.p.
- 42 Glabrous shrublets with thickish stems; **L** mostly very thick; **Inf** scape basally $\pm$ **L**-less, usually unbranched; fertile **Bra** large, overlapping and $\pm$ hiding the **Fl**; **Fl** 5- to 6-merous; **Pet** with a basal scale on each margin (Mexico): **Pachyphytum**
 – Not with this combination of characters; **Bra** never hiding the **Fl**: 43
- 43 **Pet** free to the base or slightly connate; **Fl** (4- to) 5- (to 10-) merous, long petiolate; **Pet** usually pale cream with red cross-bands or blotches, or bright pink, stellately spreading (S USA, Mexico): **Graptopetalum**
 – **Pet** slightly to distinctly connate; **Fl** 5-merous, coloration not as above: 44
- 44 Plants never shrubby but old **Ros** sometimes with short thick stems, sometimes branching dichotomously; **Bra** semi-amplexicaul, never spurred, not easily detached; **Pet** hardly to distinctly united, tubular to stellately spreading (W USA and Baja California): **Dudleya**
 – Plants shrubby or with sessile solitary or offsetting **Ros**, never dichotomously branching; **Bra** not semi-amplexicaul, spurred or not: 45
- 45 **Inf** narrow thyrses or spicate, erect, with 10 - 70 1- to 12-flowered cincinni; **Sep** subequal in size; **Pet** shortly connate, thin-textured, upper $\frac{1}{2}$ stellately spreading (Mexico): **Thompsonella**
 – **Inf** racemose, cymose-paniculate or rarely spicate; **Sep** often strongly unequal in size; **Pet** basally distinctly connate, usually distinctly fleshy, often bright pink to red (S USA to Argentina): **Echeveria**
- 46 (from 30) Minute annual herbs; **Fl** 6- to 7-merous, dirty white; **NSc** conspicuously broader than the small **Pet** (Canary Islands): **Monanthes icterica**
 – Annual to perennial herbs; **Fl** 5- to 12-merous; **NSc** inconspicuous and never broader than the **Pet**: 47
- 47 Annual herbs; **Fl** 5- to 12-merous: 48
 – Annual or perennial herbs; **Fl** 5- to 6-merous; **Pet** free to distinctly united, in various colours: 50
- 48 **Fl** 6- to 12-merous; **Pet** completely free, yellow (Canary Islands): **Aichryson** p.p.
 – **Fl** 5- to 9-merous; **Pet** hardly to distinctly connate, not yellow: 49

- 49 Annual herbs, young plants without conspicuous basal **Ros**; **Fl** white to pinkish, cup-shaped; **Pet** distinctly connate basally (SW Europe, N Africa): **Sedum** p.p. (*S. mucizonia*)
- Annual to biennial herbs, young plants with a conspicuous basal **Ros**; **Fl** inconspicuous, greenish, yellowish, whitish or dirty pinkish, shape various; **Pet** hardly connate basally (E Mediterranean): **Sedum** p.p. (*S. lampusae* etc.)
- 50 Annual herbs; **Fl** 5-merous; **Pet** long-connate forming a long tube and only the tips spreading, yellow, pink or purple (Iberian Peninsula, N Africa): **Pistorinia**
- Annual or perennial herbs; **Fl** 5- to 6-merous; **Pet** not long-connate and not forming a long tube: 51
- 51 Minute annual herbs; **Fl** 5-merous; **Fr** 1-seeded nutlets (SW USA): **Sedella** p.p.
- Annual or perennial herbs; **Fl** 5- to 7- (to 12-) merous; **Fr** many seeded follicles: 52
- 52 Plants with a tuberous **Rstock** or with cord-like thickened **R**; **Inf** dense terminal cymes, corymbose to umbellate; **Fl** (5- to) 6-merous; **Pet** basally connate for $\frac{1}{3}$ - $\frac{2}{3}$ (C Asia): **Pseudosedum**
- Plants without a tuberous **Rstock**, **R** fibrous; **Inf** various; **Fl** usually 5-merous, or 6- to 7- (to 12-) merous; **Pet** basally free (N Hemisphere to E Africa): **Sedum** p.p.

[U. Eggli]

ADROMISCHUS

E. van Jaarsveld

Adromischus Lemaire (Jard. Fleur. 2(Misc.): 58-59, 1852). **T**: *Cotyledon hemisphaerica* Linné [Lectotype, selected by H. Jacobsen, Kakt. and Sukk. 17(10): 189, 1966.]. – **Lit**: Tölken (1985: 37-60); Pilbeam & al. (1998). **D**: Namibia, RSA (esp. Northern Cape, Western Cape and Eastern Cape). **Etym**: Gr. 'hadros', thick, sturdy; and Gr. 'mischos', flower stalk; referring to the stout pedicels.

Erect to procumbent small evergreen succulent glabrous to viscid perennial herbs to ± 20 cm; **Br** succulent, terete with smooth to peeling bark, often short and contracted; **L** entire, dorsiventrally compressed to almost terete, grey to mottled green, often with powdery bloom, glabrous or glandular-hairy, linear, elliptic, ovate to obovate to clavate, base cuneate, apex obtuse, sometimes undulate; **Inf** terminal erect spike-like thyrses to 55 cm with few to numerous monochasia with 1 - 5 **Fl**; **Fl** 5-merous, erect (pendulous in *A. phillipsiae*); **Sep** short, triangular; **Cl** tubular, glabrous on the outside, lobes free, white, pinkish-purple to red, spreading to recurved, margins sometimes frilled; **St** in 2 series of 5, exserted or not; **Fil** fused to the base of the **Cl** and papillate where fused; **Anth** globose, yellow;

Ca elongate, tapering into the short **Sty** with capitate **Sti**.

A genus of 28 species, characterized by spike-like inflorescences and easily falling leaves. *Adromischus* is endemic to RSA and Namibia with concentrations of species in the Succulent Karoo of the Western Cape as well as in the Little Karoo. The most recent synopsis is by Tölken (1985) who accepts 27 species organised into 5 sections, and this treatment is followed here. *Adromischus* species are frequently cultivated as pot plants and are easily propagated by leaves. – The following sections are recognized:

- [1] Sect. *Adromischus*: **Cl** tube bright green, terete with broad, triangular, reflexed lobes with frilled margins; inside of tube **Haless**; **Anth** exserted (6 species mainly below the escarpment in Succulent Karoo and Renosterveld of the winter rainfall regions of the Northern, Western and Eastern Cape).
- [2] Sect. *Boreali* Tölken 1978: **Cl** tube slightly grooved with ovate-triangular reflexed lobes with undulate margins; inside of tube with club-shaped **Ha** in the throat; **Anth** exserted (3 species mainly in the N summer rainfall regions).
- [3] Sect. *Brevipedunculati* von Poellnitz 1940: **Cl** tube funnel-shaped, upper part slightly grooved, with ovate-triangular spreading to recurved lobes, throat of tube and lobes with club-shaped **Ha**; **Anth** exserted (6 species mainly from along the escarpment mountains and S-wards in summer and winter rainfall regions).
- [4] Sect. *Incisilobati* Uitewaal 1952: **Cl** tube terete, with lanceolate-triangular spreading to recurved lobes, throat with club-shaped **Ha**; **Anth** included (6 species mainly in the Western and Eastern Cape in winter and intermediate rainfall regions).
- [5] Sect. *Longipedunculati* von Poellnitz 1940: **Cl** tube terete, slightly grooved, with lanceolate-triangular spreading to recurved lobes, throat with club-shaped **Ha**; **Anth** included (7 species mainly in the Western, Northern and Eastern Cape in winter and intermediate rainfall regions).

The following names are of unresolved application but are referred to this genus: *Adromischus robustus* Lemaire (1852); *Cotyledon rhombifolia* Haworth (1825) $\equiv$ *Adromischus rhombifolius* (Haworth) Lemaire (1852).

A. alstonii (Schönland & Baker fil.) C. A. Smith (BT 3: 638, 1939). **T**: RSA, Northern Cape (*Alston* s.n. [GRA, SAM]). – **D**: RSA (Northern Cape); Succulent Karoo, flowers in mid-summer.

$\equiv$ *Cotyledon alstonii* Schönland & Baker fil. (1902); **incl.** *Adromischus triebneri* von Poellnitz (1939); **incl.** *Adromischus subrubellus* von Poellnitz

(1941); **incl.** *Adromischus pulchellus* Hutchison (1959).

[1] Variable decumbent to erect branched succulent herbs to 30 cm; **Br** grey with peeling bark, 12 - 14 mm Ø, younger **Br** 5 - 6 mm Ø, grey-green to brownish green; **L** 3.5 - 8 × 2 - 4.3 cm, dorsiventrally compressed, firm, not easily caducous, oblanceolate to obovate, grey with flaking wax, with or without purplish spots, upper face flat, lower face flat to convex, margin horny in upper ½, base with short indistinct sometimes subterete petiole, cuneate, apex obtuse to truncate; **Inf** 52 cm with 1- to 3-flowered cymes; buds acute; **Ped** 1 - 3 mm; **Sep** to 2.5 mm; **Cl** 9 - 12 × 2 mm, tubular, tube greenish-brown, throat **Ha**-less, lobes broadly triangular to 1.5 - 2.5 mm, white or tinged pink, cuspidate; **Anth** exserted.

A. bicolor Hutchison (CSJA 29(1): 15-17, 1957). **T:** RSA, Eastern Cape (*Hall* s.n. [BOL, NBG, PRE, UC]). – **D:** RSA (Eastern Cape); Succulent Karoo, flowers in mid-summer.

[1] Dwarf, compact, to 4 cm tall and 9 cm Ø; **R** tuberous; **Br** short, succulent, 3 mm Ø, grey-brown; **L** obovate to obtriangular, 2 - 4 × 1.5 - 4.3 cm, grey-green, densely purple spotted, biconvex, margin grey-horny, base cuneate, apex rounded to truncate to emarginate; **Inf** 12 - 25 cm, with 1- to 2-flowered cymes; **Ped** 2 mm; **Sep** to 2 mm; **Cl** 9 - 10 × 2 mm, tubular, tube yellowish-green at the base, tinged red towards the **Ha**-less throat, lobes triangular, to 2 mm, white or tinged pink, mucronate; **Anth** shortly exserted.

A. caryophyllaceus (Burm. fil.) Lemaire (Jard. Fleur. 2(Misc.): 60, 1852). **T:** [icono]: Burman, Rar. Afr. Pl. t. 17, 1738. – **D:** RSA (Western Cape); Renosterveld, Succulent Karoo, flowers in mid-summer and autumn.

≡ *Cotyledon caryophyllacea* Burmann fil. (1768); **incl.** *Cotyledon jasminiflora* Salm-Dyck (1820) ≡ *Adromischus jasminiflorus* (Salm-Dyck) Lemaire (1852); **incl.** *Cotyledon bolusii* Schönland (1903) ≡ *Adromischus bolusii* (Schönland) A. Berger (1930); **incl.** *Adromischus grandiflorus* Uite-waal (1953).

[3] Small, branched, decumbent to erect, to 11 cm tall and 14 cm Ø from a tuberous **R**stock; **Br** green at first becoming grey-green, older **Br** 5 mm Ø, younger **Br** 3 - 4 mm Ø; **L** 1 - 3 × 1.2 - 2.3 cm, ascending-spreading, easily caducous, obovate, broadly obovate to obtriangular, grey-green, unspotted, upper face flat to convex, lower face convex, margin white, horny in upper part, sometimes purplish, base cuneate, apex obtuse, truncate, rounded to rarely acute; **Inf** to 30 cm with 1 - 5 **Fl**; **Ped** 10 - 15 mm; **Sep** to 5 mm; **Cl** 10 - 13 mm, tube funnel-shaped, greenish, lobes ovate-triangular, 3 - 5 mm, tips acute, throat with club-shaped **Ha**; **Anth** included.

A. cooperi (Baker) A. Berger (NPF2 18a: 416, 1930). **T:** [icono]: Refug. Bot. 1869: t. 72. – **D:** RSA (Eastern Cape); Valley Bushveld, Noorsveld, Nama Karoo, flowers in mid-summer.

≡ *Cotyledon cooperi* Baker (1869); **incl.** *Cotyledon cooperi* var. *immaculata* Schönland & Baker fil. (1902); **incl.** *Adromischus festivus* C. A. Smith (1939); **incl.** *Adromischus pachylophus* C. A. Smith (1939); **incl.** *Adromischus cuneatus* von Poellnitz (1940) (*nom. illeg.*, Art. 53.1); **incl.** *Adromischus halesowensis* Uite-waal (1948).

[5] Shortly erect, 2 - 10 cm tall; **Br** to 15 mm Ø, grey (young 10 mm Ø, purplish), torulose due to swellings below **L** axils, with stilt-like aerial **R**; **L** 1.4 - 3 × 0.8 - 1.5 cm, ascending, becoming spreading with a terete petiole 5 - 7 mm, lamina grey with dark purple spots on upper part, slightly dorsiventrally flattened to terete and tapering at both ends, somewhat dorsiventrally flattened and with acute white horny margin towards tip, apex sometimes mucronate; **Inf** to 40 cm; buds terete, tapering, longitudinally grooved; **Ped** to 3 mm; **Cl** 10 - 12 mm with pinkish terete tube, lobes triangular-lanceolate, to 4.5 mm, acute, throat with club-shaped **Ha**; **Anth** included.

A. cristatus (Haworth) Lemaire (Jard. Fleur. 2 (Misc.): 60, 1852). **T:** OXF [Haworth s.n.]. – **D:** RSA.

≡ *Cotyledon cristata* Haworth (1827).

A. cristatus var. **clavifolius** (Haworth) Tölken (BT 12(3): 390, 1978). **T:** K [icono – lecto]. – **D:** RSA (Eastern Cape); Valley Bushveld, Noorsveld, flowers in mid-summer.

≡ *Cotyledon clavifolia* Haworth (1827) ≡ *Adromischus clavifolius* (Haworth) Lemaire (1852); **incl.** *Adromischus poellnitzianus* Werdermann (1936); **incl.** *Cotyledon nussbaumeriana* von Poellnitz (1936) ≡ *Adromischus nussbaumerianus* (von Poellnitz) von Poellnitz (1936); **incl.** *Adromischus kes-selringianus* von Poellnitz (1940).

[5] Differs from var. *cristatus*: **L** obtriangular-lanceolate, ± of the same Ø over the whole length including the upper part with horny margins; **Fl** throat with some **Ha**.

A. cristatus var. **cristatus** – **D:** RSA (Eastern Cape); Valley Bushveld, Noorsveld, flowers in mid-summer.

[5] Very variable, much branched, decumbent to erect, to 15 cm tall and Ø; **R** fibrous, aerial **R** in a dense reddish-brown mat; **Br** erect, to 4 × 0.6 - 1 cm Ø; **L** 1.5 - 3 × 1 - 1.7 cm, ascending, broadly obtriangular, dorsiventrally flattened, glabrous to hairy, green to yellowish-green, unspotted, upper face flat to convex, lower face convex, margin greenish-white, acute and horny at the apex, undulate, base cuneate, petiolate; apex obtuse, rounded or truncate; petiole terete; **Inf** to 30 cm with 1-

flowered cymes; buds spreading, terete, tapering; **Ped** 2 - 3 mm; **Sep** 2 - 3 mm; **Cl** 10 - 12 mm, tube grey-green, lobes ovate-triangular, to 3.5 mm, white to pinkish, tips acute, throat with club-shaped **Ha**; **Anth** included.

A. cristatus var. **schonlandii** (E. Phillips) Tölken (BT 12(3): 390, 1978). **T**: PRE 7944. – **D**: RSA (Eastern Cape); Valley Bushveld, Noorsveld, cliff faces and rock outcrops, flowers in mid-summer.

≡ *Cotyledon schonlandii* E. Phillips (1929) ≡ *Adromischus schonlandii* (E. Phillips) von Poellnitz (1938).

[5] Differs from var. *cristatus*: **L** easily caducous, narrowly obtriangular, upper parts narrower than the remainder, older **L** sometimes almost terete to orbicular.

A. cristatus var. **zeyheri** (Harvey) Tölken (BT 12(3): 390, 1978). **T**: RSA, Western Cape (Zeyher 2571 [K, S, SAM]). – **D**: RSA (Western Cape, Eastern Cape); Valley Bushveld, Noorsveld, shady cliffs, flowers in mid-summer.

≡ *Cotyledon zeyheri* Harvey (1862) ≡ *Adromischus zeyheri* (Harvey) von Poellnitz (1938).

[5] Differs from var. *cristatus*: **Br** longer, green, hairy, without aerial **R**, to 10 cm, little or not branched; **L** 4 - 7 × 2.2 - 5.5 cm, glandular hairy, upper margin broad and undulate; **Cl** white, glandular hairy, lobes spreading.

A. diabolicus Tölken (BT 12(4): 633, 1979). **T**: RSA, Northern Cape (Drijfhout 1942 [PRE, STE]). – **D**: RSA (Northern Cape); Nama Karoo, rock crevices, flowers in mid-summer.

[3] Dwarf, densely branched and compact, to 5 cm tall and 8 cm Ø, with tuberous **R**stock; **Br** green at first becoming grey, to 3 mm Ø; **L** 1.5 - 2 × 0.7 - 1.7 cm, easily caducous, obovate to broadly obovate or rarely orbicular, grey-green, without spots, bi-convex, or with flat upper face during drought, margin horny in upper part, base cuneate, apex obtuse, rounded to truncate; **Inf** to 15 cm with 1 - 3 **Fl**; **Ped** 5 - 10 mm; **Sep** to 3.5 mm; **Cl** 12.5 - 14 mm, tube funnel-shaped, yellowish-green, lobes ovate-triangular, 2.5 - 3.5 mm, tips acute, throat with club-shaped **Ha**; **Anth** included.

A. fallax Tölken (BT 12(3): 387, 1978). **T**: RSA, Western Cape (*Bolus* 758 [BOL, K, SAM]). – **D**: RSA (Western Cape); Nama Karoo, escarpment mountains, flowers in mid-summer.

[3] Small, low growing, sparingly branched; **R** fibrous; **Br** decumbent, to 20 cm; **L** 2 - 5 × 0.8 - 2 cm, oblanceolate to elliptic, spreading, soft, grey-green, without spots, upper face concave, lower face convex, base cuneate, apex obtuse to acute; **Inf** to 30 cm with 1 - 5 **Fl**; **Ped** 10 - 15 mm; **Sep** 4 - 5 mm; **Cl** 10 - 13 mm, tube funnel-shaped, lobes triangular-ovate, to 3 - 4.5 mm, pink to purplish, tips acute, throat with club-shaped **Ha**; **Anth** included.

A. filicaulis (Ecklon & Zeyher) C. A. Smith (BT 3: 630, 1939). **T**: RSA, Northern Cape (Ecklon & Zeyher 1975 [S]). – **D**: RSA.

≡ *Cotyledon filicaulis* Ecklon & Zeyher (1837) ≡ *Adromischus mammillaris* var. *filicaulis* (Ecklon & Zeyher) H. Jacobsen (1970) (*nom. inval.*, Art. 33.2).

A. filicaulis ssp. **filicaulis** – **D**: RSA (Northern Cape, Western Cape); Succulent Karoo, flowers in mid-summer.

Incl. *Cotyledon fusiformis* Rolfe (1916) ≡ *Adromischus fusiformis* (Rolfe) A. Berger (1930) ≡ *Adromischus mammillaris* var. *fusiformis* (Rolfe) H. Jacobsen (1970) (*nom. inval.*, Art. 33.2); **incl.** *Adromischus mammillaris* var. *rubra* von Poellnitz (1938); **incl.** *Adromischus kleiniioides* C. A. Smith (1939); **incl.** *Adromischus fragilis* Hutchison (1959); **incl.** *Adromischus fragilis* var. *numeesensis* Hutchison (1959).

[1] Erect to decumbent, sparingly branched, to 15 cm tall and 9 cm Ø; **Br** short, succulent, 7 - 12 mm Ø, grey-brown; **L** 3 - 9.5 × 0.5 - 1.7 cm, dorsiventrally compressed or sometimes terete, oblong-lanceolate to elliptic, upper face flat, lower face convex, grey-green, usually with purple spots, base cuneate, apex obtuse; **Inf** 12 - 35 cm with 1- to 3-flowered cymes; **Ped** 1 - 3 mm; **Sep** to 2 mm; **Cl** 10 - 13 × 2 mm, tube yellowish-green at base, tinged red towards the **Ha**-less throat, lobes triangular, to 2 mm, white or tinged pink, cuspidate; **Anth** shortly exerted.

A. filicaulis ssp. **marlothii** (Schönland) Tölken (BT 12(3): 385, 1978). **T**: RSA, Western Cape (*Marloth* 2520 [GRA]). – **D**: RSA (Western Cape); Succulent Karoo, flowers in mid-summer.

≡ *Cotyledon marlothii* Schönland (1915) ≡ *Adromischus marlothii* (Schönland) A. Berger (1930) ≡ *Adromischus mammillaris* var. *marlothii* (Schönland) H. Jacobsen (1970) (*nom. inval.*, Art. 33.2); **incl.** *Adromischus tricolor* C. A. Smith (1939).

[1] Differs from ssp. *filicaulis*: Decumbent to procumbent, with long stilt-**R**, sparingly branched, to 8 cm tall and 15 cm Ø; **Br** short, succulent, 3 - 4 mm Ø, grey-green with grey flaking bark; **L** 2.5 - 3.5 × 0.7 - 1.5 cm, lanceolate, elliptic to broadly elliptic, terete, reddish (young green becoming grey), not spotted, base cuneate, apex acute.

A. hemisphaericus (Linné) Lemaire (Jard. Fleur. 2(Misc.): 60, 1852). **T**: [icono]: Dillenius, Hort. Eltham., t. 95, fig. 111, 1732. – **D**: RSA (Western Cape); Renosterveld and Succulent Karoo, flowers in mid-summer. **Fig. 1.b**

≡ *Cotyledon hemisphaerica* Linné (1753); **incl.** *Cotyledon crassifolia* Salisbury (1796); **incl.** *Cotyledon rotundifolia* Haworth (1827) ≡ *Adromischus rotundifolius* (Haworth) C. A. Smith (1939).

[1] Variable, decumbent, well branched, to 15 cm tall; **Br** grey with peeling bark, 3 - 8 mm Ø (young

2 - 4 mm Ø, grey to purplish green); **L** 1 - 3.5 × 0.8 - 2.4 cm, very easily caducous, dorsiventrally compressed, ovate, oblanceolate to broadly elliptic, grey with purplish spots and flaking wax, upper face flat to convex, lower face convex, margin horny in the upper ½, base cuneate, apex obtuse to acute; **Inf** to 25 cm with 1- to 2-flowered cymes; buds acute; **Ped** 2 - 3 mm; **Sep** to 2.5 mm; **Cl** 9 - 13 × 2 mm, tube greenish-brown, throat glabrous or rarely with some club-shaped **Ha**, lobes broadly triangular, to 3.5 mm, white or tinged pink, cuspidate; **Anth** shortly exerted.

A. humilis von Poellnitz (RSN 48: 91, 1940). **T:** RSA, Northern Cape (*Marloth* 4689 [PRE]). – **D:** RSA (Northern Cape); Nama Karoo, rock crevices, flowers in mid-summer.

Incl. *Cotyledon humilis* Marloth (1915) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon nana* Marloth (1910) (*nom. illeg.*, Art. 53.1).

[3] Dwarf, 1-stemmed or sparingly branched, to 2 cm tall from a tuberous **Rstock**; **R** fusiform; **Br** green at first becoming grey, to 15 mm Ø; **L** 1 - 2.4 × 0.5 - 1.2 cm, spreading, soft, obovate to rarely orbicular, grey-green, mottled with purple spots or without spots, upper face concave to channelled, lower face convex, often purplish, base cuneate, apex obtuse to rounded; **Inf** to 30 cm with up to 3 monochasia each with 1 - 3 **Fl**; **Ped** 8 - 16 mm; **Sep** 2 - 3.5 mm; **Cl** 10 - 12 mm, tube funnel-shaped, yellowish-green, lobes broadly triangular-ovate, to 3.5 mm, reddish purple, tips acute, throat with club-shaped **Ha**; **Anth** just reaching the throat.

A. inamoenus Tölken (BT 12(3): 388, 1978). **T:** RSA, Eastern Cape (*Tölken* 5508 [PRE]). – **D:** RSA (Eastern Cape); Noorsveld and Valley Bushveld, flowers in mid-summer.

[4] Erect sparingly branched shrublets to 9 cm tall and 11 cm Ø; **R** fibrous; **Br** succulent, brown, to 13 mm Ø at base, **L**-bearing **Br** 8 mm Ø; **L** dorsiventrally compressed, obovate to obtriangular, 4 - 5 × 2.5 - 4.5 cm, grey-green to silvery green, wax cover sometimes peeling in small flakes, without spots (young **L** green, shiny), margin acute, reddish, not decurrent on petiole, upper face flat to convex, lower face convex, base cuneate, apex rounded to emarginate; **Inf** 20 - 30 cm with 1- to 2-flowered cymes with sessile **Fl**; buds terete, tapering; **Sep** 1.5 - 2.5 mm, brownish-green; **Cl** terete, slightly tapering towards throat, 9 - 12 × 3 mm, lobes lorate-lanceolate, white tinged pink, throat with club-shaped **Ha**; **Anth** included.

A. leucophyllus Uitewaal (Nation. Cact. Succ. J. 9: 58, fig., 1954). **T:** RSA, Western Cape (*Hall* s.n. [AVU]). – **D:** RSA (Western Cape); Succulent Karoo, flowers in mid-summer. **Fig. 1c**

[5] Dwarf, sparingly branched, spreading to 5.5 × 13 cm; **R** fibrous, often as stilt-**R**; **Br** succulent,

grey-green with powdery bloom, to 5 mm Ø at base, **L**-bearing **Br** 2 - 3 mm Ø; **L** 1 - 3 × 0.8 - 2.5 cm, dorsiventrally compressed, obovate to sub-orbicular, very easily caducous, young **L** pale green with powdery bloom, older **L** grey-green, occasionally with few purplish spots but usually unspotted, margin horny, acute and decurrent on petiole, upper face flat to convex, lower face convex, base cuneate, apex rounded, mucronate; **Inf** to 15 cm with 1- to 4-flowered cymes; buds terete, tapering; **Sep** 2 - 2.5 mm; **Cl** terete and slightly widening towards the throat, 11 - 13 × 3 mm, lobes triangular-lanceolate, white with pink midstripes, throat with club-shaped **Ha**; **Anth** included.

Plants from the Warmwaterberg are much smaller and the leaves do not exceed 1.5 cm.

A. liebenbergii Hutchison (CSJA 31: 81, fig. 40, 1959). **T:** RSA, Eastern Cape (*Liebenberg* 6186 [BOL]). – **D:** RSA (Eastern Cape); Succulent Karoo, flowers in mid-summer.

[1] Erect, sparingly branched, to 20 cm tall; **R** tuberous; **Br** erect, short, succulent, to 7 mm Ø, brown-green (young 5 mm Ø, green); **L** 2 - 5 × 1.2 - 3 cm, firm, not easily caducous, dorsiventrally compressed, rhombic-spatulate to oblong-lanceolate, bi-convex, grey-green, usually without purple spots, base cuneate and subterete, apex obtuse to acute; **Inf** to 10 cm with 1-flowered cymes; **Ped** to 3 mm; **Sep** to 2 mm; **Cl** 10 - 11.5 × 2 mm, tube light green at base, tinged red towards the **Ha**-less throat, lobes broadly triangular, to 2 mm, white or tinged pink, mucronate; **Anth** shortly exerted.

A. maculatus (Salm-Dyck) Lemaire (Jard. Fleur. 2(Misc.): 60, 1852). **T:** [lecto]: OXF [sub Haworth s.n., sine loco]. – **D:** RSA (Western Cape); Succulent Karoo, flowers in mid-summer.

≡ *Cotyledon maculata* Salm-Dyck (1820); **incl.** *Cotyledon alternans* Haworth (1819) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon maculata* Haworth (1821) (*nom. illeg.*, Art. 53.1).

[4] Little branched, decumbent to erect, to 10 cm tall and 15 cm Ø; **Br** green at first and to 7 mm Ø, becoming grey-green and 10 - 12 mm Ø with peeling bark; **L** 2.5 - 3.5 × 1.7 - 3.2 cm, ascending-spreading, easily caducous, oblanceolate to obovate, to almost orbicular, grey-green and with dark purple spots, upper face flat to convex, lower face convex, margin white, acute, horny for most of the length, base cuneate, subpetiolate and nearly terete, apex obtuse or rounded, mucronate or not; **Inf** to 35 cm with 1- to 2-flowered cymes; buds spreading, terete, tapering; **Ped** 1 - 4 mm; **Sep** 1.5 - 2 mm; **Cl** 8 - 11 mm, tube greenish-yellow, throat with club-shaped **Ha**, lobes lanceolate-triangular, 3 - 5 mm, white to pale pink, tips acute; **Anth** included.

A. mammillaris (Linné *fil.*) Lemaire (Jard. Fleur. 2(Misc.): 60, 1852). **T:** RSA, Western Cape (*Thun-*

berg s.n. [UPS [Herb. Thunberg 11006]]). – **D:** RSA (Western Cape); Succulent Karoo, flowers in mid-summer.

≡ *Cotyledon mammillaris* Linné fil. (1782).

[4] Decumbent to erect, sparingly branched, to 15 cm tall; **R** fibrous; **Br** brown, to 8 mm Ø, older **Br** with bark peeling in greyish flakes; **L** 2.5 - 4 × 0.8 - 1.3 cm, dorsiventrally flattened when young and brownish green, almost terete when old becoming distinctly grey-green with few darker spots, linear obovate to club-shaped, persistent and functional for more than one season, margin horny and reddish near apex, otherwise not noticeable, base cuneate, apex obtuse, mucronate; **Inf** 25 - 41 cm; **Ped** 1 - 3 mm; buds terete, tapering and curving outwards towards apex; **Sep** 2 × 2 mm, grey; **Cl** 13 - 15 mm, tube terete, lobes triangular-lanceolate, to 5 mm, white tinged pink, throat with club-shaped **Ha**; **Anth** included.

This name was misinterpreted by most modern authors, whose concept equates *A. filicaulis* ssp. *marlothii* (Tölken 1985: 43).

A. marianiae (Marloth) A. Berger (NPF2 18a: 416, 1930). **T:** RSA, Western Cape (Marloth 3489 [PRE, GRA, K]). – **D:** RSA. **I:** Tölken (1985: 58).

≡ *Cotyledon marianiae* Marloth (1907).

A. marianiae var. *hallii* (Hutchison) Tölken (BT 12(3): 391, 1978). **T:** RSA, Northern Cape (Hall s.n. [BOL, PRE, UC]). – **D:** S Namibia, N RSA (Northern Cape).

≡ *Adromischus hallii* Hutchison (1956); **incl.** *Adromischus casmithianus* von Poellnitz (1940) (*nom. inval.*).

[5] Differs from var. *marianae*: Small and compact plants with thick stems; **R** tuberous; **L** broadly obovate to orbicular, 1.5 - 2.5 cm, grey to reddish green, occasionally spotted, lamina smooth, dorsiventrally flattened to globose, with raised horny margin in the upper ½.

A. marianiae var. *immaculatus* Uitewaal (Succulenta 1953: 10, ill., 1953). **T:** RSA, Western Cape (Anonymus s.n. [AVU 10014]). – **D:** RSA (Western Cape).

Incl. *Cotyledon herrei* W. F. Barker (1931) ≡ *Adromischus herrei* (W. F. Barker) von Poellnitz (1938) ≡ *Adromischus marianiae* fa. *herrei* (W. F. Barker) Pilbeam (1981); **incl.** *Adromischus anticordatum* von Poellnitz (1938); **incl.** *Adromischus antidorcatum* von Poellnitz (1938); **incl.** *Adromischus alveolatus* Hutchison (1956) ≡ *Adromischus marianiae* fa. *alveolatus* (Hutchison) Pilbeam (1981); **incl.** *Adromischus marianiae* fa. *multicolor* Pilbeam (1981) (*nom. inval.*, Art. 37.1).

[5] Differs from var. *marianae*: Densely branched, constricted at the base; **R** tuberous; **L** variable in shape and texture, lanceolate to oblanceolate, 1.5 - 5 cm, lamina slightly dorsiventrally flat-

tened to terete, grooved in the upper ½, surface green becoming grey or reddish to brownish green, smooth or tuberculate, margin white to brown and horny near apex.

A. marianiae var. *kubusensis* (Uitewaal) Tölken (BT 12(3): 391, 1978). **T:** RSA, Northern Cape (Herre s.n. [AVU 10012]). – **D:** RSA (Northern Cape).

≡ *Adromischus kubusensis* Uitewaal (1953); **incl.** *Adromischus rodinii* Hutchison (1953); **incl.** *Adromischus blosianus* Hutchison (1957); **incl.** *Adromischus geyeri* Hutchison (1960).

[5] Differs from var. *marianae*: Branched, with thick stems; **L** oblanceolate to linear-oblanceolate, 3 - 11 × 1.5 - 2 cm, lamina dorsiventrally compressed, biconvex or upper face flat, spotted or not, margin reddish.

A. marianiae var. *marianiae* – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo, flowers in mid-summer.

Incl. *Adromischus marianae* hort. (s.a.) (*nom. inval.*, Art. 61.1).

[5] Short, erect, sparingly branched, to 12 cm tall; **Br** to 18 mm Ø, grey, young **Br** to 8 mm Ø, green; **L** variable, 4 - 8 × 1.3 - 2.2 cm, linear-elliptic to linear-lanceolate, ascending, petiole short, indistinct, terete, lamina slightly dorsiventrally flattened, grey with few scattered purple spots, upper face flat to concave, lower face convex, margin raised, white to pink, horny in the upper ½ to ⅓, apex obtuse to acute, mucronate; **Inf** to 35 cm with 1- to 3-flowered cymes; **Ped** 2 - 6 mm; buds terete, tapering, longitudinally grooved; **Cl** 10 - 12 mm, tube pinkish, terete, lobes triangular-lanceolate, to 3 mm, acute, throat with club-shaped **Ha**; **Anth** included.

A. maximus Hutchison (CSJA 31: 133, figs. 59-60, 1959). **T:** RSA, Western Cape (Hall s.n. [BOL]). – **D:** RSA (Western Cape); Succulent Karoo, flowers in mid-summer. **Fig. 1d**

[4] Large and robust, erect to decumbent, sparingly branched, to 30 cm tall and Ø; **Br** to 3 cm Ø, with grey peeling bark in horizontal strips, **L**-bearing younger **Br** 1.2 - 2 cm Ø; **L** oblanceolate to obovate, 6 - 13 × 2.5 - 4.5 cm, dorsiventrally flattened, ascending-spreading, grey-green, unspotted, margin sharp and horny, base cuneate with indistinct petiole, apex obtuse, mucronate; **Inf** to 33 cm with short 1- to 3-flowered dichasia; **Ped** 1 - 3 mm; buds terete, tapering, green with pink tips; **Sep** triangular, 1 - 2 × 1 - 2 mm, grey; **Cl** 10 - 14 mm, tube cylindrical to 4.5 mm Ø, green, throat with club-shaped **Ha**, lobes white with pinkish margins, lanceolate, 5 × 2 mm; **Anth** yellow, included.

A. montium-klingshardtii (Dinter) A. Berger (NPF2 18a: 416, 1930). **T:** Namibia (Dinter 4265

[B †]). – **D:** Namibia, RSA (Northern Cape); Succulent Karoo, flowers in mid-summer.

≡ *Cotyledon montium-klinghardtii* Dinter (1923).

[1] Variable, decumbent, well branched, to 16 cm tall; **Br** grey with peeling bark, 7 - 10 mm Ø, younger **Br** 4 mm Ø, brownish-green; **L** 2.5 - 3 × 1 - 1.8 cm, dorsiventrally compressed to subterete, very easily caducous, obovate, ovate, to almost orbicular, grey with flaking wax, without purplish spots, biconvex, rarely with flat upper face, margin horny, base with short indistinct petiole, cuneate, apex obtuse to rounded; **Inf** to 22 cm with 1-flowered cymes; buds acute; **Ped** 2 - 3 mm; **Sep** to 2.5 mm; **Cl** 11 - 14 × 2 mm, tube greenish, throat **Ha**-less, lobes broadly triangular, to 1 - 2 mm, white or tinged pink, cuspidate; **Anth** shortly exerted.

A. nanus (N. E. Brown) von Poellnitz (Desert Pl. Life 10: 222, 1938). **T:** RSA, Northern Cape (*MacOwan* s.n. [K]). – **D:** RSA (Northern Cape); Nama Karoo, rock crevices, flowers in mid-summer.

≡ *Cotyledon nana* N. E. Brown (1901); **incl.** *Adromischus pauciflorus* Hutchison (1960).

[3] Dwarf and compact, to 4.5 cm tall and 5.5 cm Ø; **R** tuberous; **Br** short, succulent, to 8 mm Ø, grey; **L**-bearing **Br** 3 - 4 mm Ø; **L** obovate to broadly obovate, 0.6 - 1.3 × 0.6 - 1 cm, green to grey-green, unspotted, biconvex, margin horny in upper part, base cuneate, apex obtuse to truncate; **Inf** to 4 cm with 1 - 2 cymes each with 1 - 3 **Fl**; **Ped** 8 - 20 mm; **Sep** triangular-lanceolate, 1.3 mm; **Cl** 11 - 15 mm, funnel-shaped, 2 mm Ø at the base widening to 4 mm at the throat, tube green at base, mauve towards the throat, with darker purple median streaks, lobes ovate-triangular, 3 × 2.5 mm, acute; throat with club-shaped **Ha**; **Anth** just reaching the throat.

This taxon has been confused in the past with *A. marianiae* var. *hallii*.

A. phillipsiae (Marloth) von Poellnitz (RSN 48: 88, 1940). **T:** RSA, Western Cape (*Marloth* 3912 [PRE, BOL, GRA, SAM]). – **Lit:** Bruyns (1998: with ill.). **D:** RSA (Western Cape); Nama Karoo, escarpment mountains, flowers in mid-summer. **Fig. I.a**

≡ *Cotyledon phillipsiae* Marloth (1907).

[3] Dwarf, low growing with stolons and forming small clusters, to 5 cm tall from a tuberous **R**stock; **Br** to 1.5 cm Ø; **L** numerous, 1.5 - 4.5 × 0.4 - 1.3 cm, soft, spreading, linear oblanceolate to elliptic, grey-green, unspotted, upper face channelled, lower face convex, base cuneate, apex obtuse to acute; **Inf** to 35 cm with up to 3 monochasia each with 1 - 5 pendent **Fl**; **Ped** 15 - 35 mm; **Sep** 3 - 5 mm; **Cl** 18 - 20 mm, tube funnel-shaped, orange-red, lobes triangular-ovate, 3 - 5 mm, reddish, acute, throat papillate; **Anth** just reaching the throat.

This is the most curious member of the genus and

easily recognized by its soft grey-green leaves and the pendent orange-red flowers.

A. roanianus Uitewaal (Nation. Cact. Succ. J. 7: 69-70, ill., 1952). **T:** RSA, Western Cape (*Herre* s.n. [AVU 10011]). – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo, flowers in mid-summer. **I:** Tölken (1985: 45). **Fig. I.f, I.g**

[1] Decumbent, sparingly branched, to 20 cm tall; **Br** zigzag, to 6 mm Ø, brown-green, younger **Br** green to reddish-green, 3 mm Ø; **L** 2.5 - 5 × 1.3 - 3 cm, dorsiventrally compressed, obovate to oblanceolate, grey-green, usually unspotted, upper face flat, lower face convex, margin horny, base cuneate, apex obtuse to acute; **Inf** to 38 cm with 1-flowered cymes; buds acute; **Ped** 2 - 4 mm; **Sep** to 2 mm; **Cl** 10 - 14.5 × 2 mm, tube light green at the base, tinged red towards the **Ha**-less throat, lobes broadly triangular, to 3 mm, white or tinged pink, cuspidate; **Anth** shortly exerted.

A. schuldtianus (von Poellnitz) H. E. Moore (Baileya 20: 29, 1976). **T:** B [†]. – **D:** Namibia, RSA.

≡ *Cotyledon schuldtiana* von Poellnitz (1936).

A. schuldtianus ssp. **juttae** (von Poellnitz) Tölken (BT 12(3): 386, 1978). **T:** Namibia (*Triebner* 1315 [B †]). – **D:** S Namibia; Nama Karoo, flowers in mid-summer.

≡ *Adromischus juttae* von Poellnitz (1939).

[2] Differs from ssp. *schuldtianus*: **Br** 4 - 10 cm long, sparingly branched, with tuberous base.

A. schuldtianus ssp. **schuldtianus** – **D:** C Namibia to RSA (Northern Cape); Nama Karoo, flowers in mid-summer.

[2] Dwarf, compact, to 7 cm tall and 15 cm Ø; **R** fibrous; **Br** tapering, decumbent, basally tuberous to 4 cm Ø and more, grey to grey-green with peeling bark; otherwise 8 - 10 mm Ø, younger **L**-bearing **Br** 5 - 7 mm Ø; **L** 1 - 4 × 0.4 - 1.5 cm, ascending, dorsiventrally compressed, easily caducous, oblanceolate, obovate to orbicular, grey-green, mottled with few maroon spots or unspotted, margin acute in upper ½, horny, undulating and often with a maroon to purplish tinge, upper face flat to convex, lower face convex, base cuneate, apex rounded to obtuse; **Inf** to 40 cm with 1-flowered cymes; **Ped** 3 - 12 mm; buds erect, grooved, gradually tapering; **Sep** to 3 mm; **Cl** 10 - 13 × 2 mm, tube dull green to white, lobes triangular-ovate, to 2.5 mm, white or tinged pink, acute, throat with club-shaped **Ha**; **Anth** just reaching the throat.

A. sphenophyllus C. A. Smith (BT 3: 624, 1939). **T:** RSA, Eastern Cape (*Cooper* 2338 [K]). – **D:** RSA (Eastern Cape); Noorsveld and Valley Bushveld, flowers in mid-summer.

Incl. *Adromischus rhombifolius* var. *bakeri* von Poellnitz (1940).

[4] Erect sparingly branched shrublets to 20 cm; **R** fibrous; **Br** succulent, grey, to 28 mm Ø at the base, **L**-bearing **Br** 8 - 10 mm Ø; **L** dorsiventrally compressed, oblanceolate to obovate, 5.5 - 9.5 × 2.5 - 4.5 cm, grey-green to silvery green (young green and shiny), unspotted, wax cover sometimes peeling in small flakes, margin acute, horny, sometimes undulating, and decurrent on the petiole, upper face flat to convex, lower face convex, base cuneate, apex obtuse to rounded; **Inf** to 3 - 4.5 cm with 1-flowered cymes; **Fl** sessile; buds ascending, terete, tapering, red-tipped; **Sep** 3 × 1.75 mm, glaucous; **Cl** terete, slightly tapering towards the throat, 10 - 12 × 3 mm, lobes loriate-lanceolate, white, with purplish streaks on the outside, throat with club-shaped **Ha**; **Anth** included.

Material from Kouga (Eastern Cape) has distinctly undulating leaves.

A. subdistichus Makin ex Bruyns (SAJB 58(1): 50-51, ill., 1992). **T**: RSA, Eastern Cape (*Bruyns* 2887 [BOL]). – **D**: RSA (Western Cape, Eastern Cape); Succulent Karoo and Renosterveld, flowers in mid-summer.

[5] Little branched, small, decumbent to erect, to 7 cm tall and 15 cm Ø; **R** fibrous; **Br** green at first and to 3 mm Ø becoming grey-green and 4 - 5 mm Ø; **L** 1.5 - 2 × 1 - 1.7 cm, spreading to ascending, easily caducous, obovate, grey-green, shiny, sometimes tinged purplish but unspotted, upper face flat to convex, lower face convex, margin white, acute, horny for most of the length and shortly decurrent on stem, base auriculate, apex obtuse or rounded, mucronate; **Inf** to 18 cm with 1- to 2-flowered cymes; buds spreading, terete, tapering; **Ped** 4 - 8 mm; **Sep** to 2 mm; **Cl** 11 - 12 mm, tube greenish-yellow, lobes lanceolate-triangular, 3 - 4 mm, pink, acute, throat with club-shaped **Ha**; **Anth** shortly exserted.

A. subviridis Tölken (BT 12(3): 391, 393, 1978). **T**: RSA, Northern Cape (*Tölken* 5349 [PRE]). – **D**: RSA (Northern Cape); Succulent Karoo, flowers in mid-summer.

[5] Little branched, decumbent to erect, to 15 cm tall and Ø; **R** fibrous; **Br** grey-white, to 8 mm Ø, with powdery bloom; **L** 3.5 - 7 × 2.8 - 3.8 cm, ascending, easily caducous, oblanceolate to obovate, grey-green with dark purple spots, covered with powdery bloom, upper face flat, lower face convex, margin white, acute and horny over the whole length, base cuneate, subpetiolate, apex obtuse or rounded, mucronate; **Inf** to 25 cm with 1- to 2-flowered cymes; **Ped** 4 - 6 mm; **Sep** 2 - 3 mm; buds spreading, terete, tapering; **Cl** 9 - 11 mm, tube green, farinose, lobes lanceolate-triangular, 3 - 4 mm, pale yellow, tinged pink, acute, throat with club-shaped **Ha**; **Anth** included.

A. triflorus (Linné *fil.*) A. Berger (NPF2 18a: 416,

1930). **T**: RSA, Western Cape (*Thunberg* s.n. [UPS (Herb. Thunberg 11 016)]). – **D**: RSA (Western Cape); Succulent Karoo, flowers in mid-summer.

≡ *Cotyledon triflora* Linné *fil.* (1782); **incl.** *Cotyledon bolusii* var. *karroensis* Schönland (1904); **incl.** *Cotyledon procurva* N. E. Brown (1912) ≡ *Adromischus procurvus* (N. E. Brown) C. A. Smith (1939); **incl.** *Adromischus subcompressus* von Poellnitz (1938); **incl.** *Adromischus subpetiolatus* von Poellnitz (1938).

[4] Little branched, small, decumbent to erect, to 12 cm tall and 15 cm Ø; **Br** green at first and 3 - 5 mm Ø, becoming grey to grey-brown and to 1 cm Ø, with peeling bark; **L** 2 - 4.5 × 1.2 - 4 cm, ascending-spreading, easily caducous, obtriangular to obovate, rarely obovately club-shaped, grey-green and unspotted at first, with dark purple spots towards the apex when older, upper face flat to convex, lower face convex, margin white, horny in the upper part, sometimes purplish, base cuneate, subpetiolate, terete, apex obtuse, truncate, rounded to emarginate; **Inf** to 35 cm with 1- to 5-flowered cymes; buds terete, tapering and curved at the apex; **Ped** 1 - 6 mm; **Sep** 1.5 - 2 mm; **Cl** 8 - 10 mm, tube greenish-yellow, lobes lanceolate-triangular, 3 - 5 mm acute, throat with club-shaped **Ha**; **Anth** included.

A. trigynus (Burchell) von Poellnitz (RSN 44: 61, 1938). **T**: RSA, Cape Prov. (*Burchell* 1898 [K]). – **D**: RSA (Northern Cape, Free State); Nama Karoo, flowers in mid-summer. **Fig. 1e**

≡ *Cotyledon trigyna* Burchell (1824); **incl.** *Cotyledon rhombifolia* var. *spathulata* N. E. Brown ex Marloth (1925) (*nom. nud.*); **incl.** *Adromischus rupicola* C. A. Smith (1939).

[2] Dwarf, compact, to 4.5 cm tall and 12 cm Ø; **R** fibrous; **Br** decumbent, short, basally tuberous to 3 cm Ø and more, grey-green, younger **L**-bearing **Br** to 6 mm Ø; **L** compactly arranged, ascending, obovate, oblanceolate, rarely orbicular, 1.5 - 3 × 1.5 - 2.9 cm, grey-green, mottled and often with a maroon purplish marginal tinge, upper face flat to concave during winter, lower face convex, margin acute, grey-white, horny for ± upper ⅓, base cuneate, apex rounded to obtuse; **Inf** to 35 cm with 1- to 2-flowered subsessile cymes; buds erect, 5-angled, gradually tapering; **Ped** 2 - 6 mm; **Sep** to 3 mm; **Cl** 10 - 13 × 2 mm, tubular, longitudinally grooved, tube yellowish-green at base, covered with powdery bloom, lobes ovate, to 2.5 mm, white or tinged pink, acute, throat **Ha**-less; **Anth** shortly exserted.

A. umbraticola C. A. Smith (J. Vet. Sci. Anim. Ind. 1: 174, 1933). **T**: RSA, Gauteng (*Smith* 3432 [PRE]). – **D**: RSA.

A. umbraticola ssp. *ramosus* Tölken (BT 12(3): 386, 1978). **T**: RSA, Northern Prov. (*Tölken* 1215 [PRE]). – **D**: RSA (Northern Prov.); Bushveld, flowers in mid-summer.

[2] Differs from ssp. *umbraticola*: **Br** longer, 4 - 12 cm, sparingly branched, base tuberous; **L** greenish-brown to grey-green, unspotted.

A. umbraticola ssp. *umbraticola* – **D**: RSA (Northern Cape, Northern Prov., Gauteng); Bushveld, flowers in mid-summer.

Incl. *Adromischus saxicola* C. A. Smith (1939).

[2] Dwarf, compact, to 12 cm tall and 15 cm Ø; **R** fibrous; **Br** decumbent, short, basally tuberous to 4 cm Ø and more, grey to grey-green with peeling bark, otherwise **Br** 10 - 15 mm Ø, younger **L**-bearing **Br** to 5 mm Ø; **L** 10 - 70 × 5 - 21 mm, dorsiventrally compressed, easily caducous, ascending, linear oblanceolate to club-shaped obovate, grey-green, mottled with maroon or unspotted, often with a maroon-purplish tinge along the margins, upper face convex to flat during winter, lower face convex, margin horny near the tip, base cuneate, apex rounded to obtuse; **Inf** to 35 cm with 1-flowered cymes stalked 1.5 - 3.5 mm; buds erect, 5-angled, gradually tapering; **Ped** 2 - 10 mm; **Sep** to 3 mm; **Cl** 10 - 13 × 2 mm, tube dull green, longitudinally grooved, lobes triangular-ovate, to 2.5 mm, white or tinged pink, acute, throat with club-shaped **Ha**; **Anth** shortly exerted.

AEONIUM

R. Nyffeler

Aeonium Webb & Berthelot (Phytogr. Canar. 1: 184, 1840). **T**: *Sempervivum arboreum* Linné [Lectotype, selected by H.-Y. Liu 1989.]. – **Lit**: Praeger (1932); Voggenreiter (1974); Liu (1989); Bramwell & Bramwell (1990); Press & Short (1994). **D**: Macaronesia (Canary Islands, Cape Verde Islands, Madeira), SW Morocco, E Africa (Ethiopia, Somalia, Kenya, Tanzania, Uganda), S Arabia (Yemen). **Etym**: Gr. 'aionion', everliving plant; referring to the succulent nature and the assumed longevity of the plants.

Incl. *Greenovia* Webb & Berthelot (1840). **T**: *Sempervivum aureum* C. Smith [Typification according to ING, declared as lectotypification by Mes in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 41, 1995.].

Incl. *Aldasorea* Hort. ex Haage & Schmidt (1930). **T**: not typified.

Incl. ×*Greenonium* G. D. Rowley (1958). **T**: *G. do-drantalii* × *A. haworthii*.

Incl. *Megalonium* (A. Berger) G. Kunkel (1980). **T**: *Sempervivum nobile* Praeger.

Biennial or mostly perennial, densely to few-branched or single-stemmed, sometimes monocarpic subshrubs or single or caespitose, subcaulescent **Ros** plants; **R** fibrous; **Br** often ascending, partly in groups or tortuous, glabrous or puberulent (densely hirsute in *A. smithii*), smooth or with reticulate pattern, often with distinct **L** scars; **Ros** flat-

tish with inner **L** tightly appressed to each other or ± erect, or rather cup-shaped, often ± globose and tightly closed during dry season; **L** simple, sessile with a broad base, fleshy to distinctly succulent, spirally arranged, often obovate or obovate-spatulate, occasionally ovate, elliptic or trullate, apically acute, acuminate or rounded, caudate or retuse, basally cuneate or rarely distinctly attenuate, green or yellowish-green, often variously pinkish or reddish variegated, glabrous, glabrate or pubescent, sometimes glaucous or viscid, occasionally glossy, margins often with distinct ± straight or forward-curved, bead-shaped or conical unicellular **Ha** (= cilia); **Inf** terminal (from basal **Ros** axils in *A. simsii*), often semiglobose, ovoid or conical, peduncle distinct, often densely leafy; **Ped** 1 - 16 mm, glabrous, puberulent or distinctly pubescent; **Fl** (6- to) 7- to 12- (to 16-) or 18- to 32-merous, 12 - 25 mm Ø; **Sep** fleshy, basally connate, glabrous or pubescent; **Pet** free, spreading or slightly recurved, often lanceolate or oblanceolate, occasionally obovate, commonly acute or acuminate, pale to deep yellow or whitish and then often variously reddish variegated; **St** 2× as many as **Pet**; **Fil** free, filiform, glabrous or puberulent; **Anth** cylindrical, variously yellow; **NSc** 0.5 - 1.5 × 0.3 - 1.2 mm, square or oblong, cuneate, sometimes absent; **Ca** as many as **Pet**, sometimes distinctly immersed in the **Rec**, glabrous or often with some glandular **Ha**; **Se** papillate or most often costate, brownish.

The subsequent treatment follows the revision by Liu (1989). Some groups of taxa (e.g. Sect. *Chrysocome*, Sect. *Patinaria*) do no longer pose taxonomic problems, others are still not reliably resolved (Sect. *Greenovia*, Sect. *Leuconium*):

[1] Sect. *Aeonium* (incl. Sect. *Holochrysa* (Christ) Praeger 1932): Rather large, few-branched or occasionally 1-stemmed subshrubs; **L** often glossy, margins conspicuously ciliate; **Inf** mostly somewhat ovoid; **Fl** yellowish.

[2] Sect. *Chrysocome* Webb in Christ 1888 (≡ Ser. *Chrysocome* H.-Y. Liu 1989; incl. Sect. *Auonium* A. Berger 1930, Sect. *Petrothamnium* (Webb in Christ) H.-Y. Liu 1989, Sect. *Goochia* (Christ) Praeger 1932, Sect. *Anodontonium* A. Berger 1930, Sect. *Trichonium* A. Berger 1930, Ser. *Simsii* H.-Y. Liu 1989): Small densely branched shrublets or caespitose **Ros** plants; **L** often viscid, partly with conspicuous longitudinal brownish stripes on lower face; **Inf** lax, rather few-flowered; **Fl** yellow.

[3] Sect. *Greenovia* (Webb & Berthelot) Mes 1995: **Ros** solitary or stoloniferous, rather small; **L** partly with a hyaline margin or densely glandular-hairy; **Inf** densely leafy, ± compact false umbels; **Fl** 18- to 32-merous, deep yellow.

[4] Sect. *Leuconium* A. Berger 1930 (incl. Sect. *Megalonium* A. Berger 1930, Sect. *Nobilis* Praeger ex A. Berger 1930 *pro syn.*, Sect. *Urbica* (Christ) Praeger 1932): Densely to few-

branched, medium to rather large, often monocarpic subshrubs; **L** often glaucous, ciliate, variously reddish variegated esp. along the margins; **Inf** often somewhat conical or semiglobose, $\pm$ many-flowered; **Fl** whitish, variously reddish variegated.

- [5] Sect. *Patinaria* (R. Lowe) A. Berger 1930 ($\equiv$ Ser. *Patinaria* H.-Y. Liu 1989; incl. Sect. *Canariensis* (Christ) Praeger 1932, Sect. *Pittonium* A. Berger 1930, Ser. *Praegeri* H.-Y. Liu 1989): 1-stemmed or caespitose, rather large **Ros** plants; **L** often velvety and sometimes viscid; **Inf** rather lax, leafy, many-flowered; **Fl** pale yellowish.

Hybridization is quite common among sympatrically occurring taxa, and numerous hybrid combinations and names have been published, cf. Santos Guerra (1983) and Bañares Baudet (1990). The following list attempts to include the published hybrid names for the sake of completeness, but space does not allow to indicate the hybrid formula associated with each: *A. $\times$ aguajilvense*, *A. $\times$ anagense*, *A. $\times$ beltranii*, *A. $\times$ bollei*, *A. $\times$ bramwellii*, *A. $\times$ bravoanum*, *A. $\times$ burchardii*, *A. $\times$ castellodecorum*, *A. $\times$ castelloplanum*, *A. $\times$ cilifolium*, *A. $\times$ edgari*, *A. $\times$ hawbicum*, *A. $\times$ holospathulatum*, *A. $\times$ hybridum* (incl. *A. $\times$ floribundum*), *A. $\times$ isorense*, *A. $\times$ jacobseii*, *A. $\times$ junionae*, *A. $\times$ kunkelii*, *A. $\times$ lambii*, *A. $\times$ lemisii*, *A. $\times$ lidii*, *A. $\times$ lowei*, *A. $\times$ mascaense*, *A. $\times$ meridionale*, *A. $\times$ mixtum*, *A. $\times$ nogalesii*, *A. $\times$ occidentale*, *A. $\times$ ombriosum*, *A. $\times$ orbelindense*, *A. $\times$ perezii*, *A. $\times$ praegeri*, *A. $\times$ pseudohawbicum*, *A. $\times$ rowleyi*, *A. $\times$ sanchezii*, *A. $\times$ sancti-sebastiani*, *A. $\times$ santosianum*, *A. $\times$ splendens*, *A. $\times$ sventenii*, *A. $\times$ tabulicum*, *A. $\times$ tenense*, *A. $\times$ teneriffae*, *A. $\times$ timense*, *A. $\times$ vegamorae*, *A. $\times$ velutinum*, *A. $\times$ voggenreiteri*, and *A. $\times$ wildpretii*.

Since *Greenovia* is no longer recognized, the hybrid names published under $\times$ *Greenonium* also belong here: *G. bramwellii*, *G. cabreræ* = *A. $\times$ cabreræ*, *G. extinctum*, *G. lambii*, *G. laxiflorum*, *G. riosjordani*, *G. rowleyi*, and *G. tijarafense* (= *A. $\times$ tijarafense*).

Moreover, the name *Greenovia $\times$ aureozoon* covers the combination *A. aizoon* $\times$ *A. aureum*.

The following name is of unresolved application but is referred to this genus: *Aeonium webbii* Bolle (1859).

A. aizoon (Bolle) Mes (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 41, 1995). – **D:** Canary Islands (C Tenerife); 600 - 1600 m. **Fig. II.a**

$\equiv$ *Greenovia aizoon* Bolle (1859) $\equiv$ *Sempervivum aizoon* (Bolle) Christ (1888); **incl.** *Greenovia quadrantal* Webb in Christ (1888) (*nom. inval.*, Art. 34.1c).

[3] Caespitose perennials; **Ros** 3 - 5 cm $\varnothing$, flat-tish, rather open during the dry season; **L** 2 - 3.5 $\times$ 1

- 1.5 cm, 1 - 2 mm thick, oblong-spatulate, apically truncate, apiculate, basally broadly attenuate from near the tip, densely glandular-pubescent, viscid, green; **Inf** flat-topped, floriferous part 2 - 5 $\times$ 4 - 10 cm, commonly 10- to 40-flowered; peduncle 8 - 12 cm, densely leafy; **Ped** 1 - 3 mm, pubescent; **Fl** 17- to 21-merous; **Sep** pubescent; **Pet** 6 - 7 $\times$ 1 - 1.5 mm, obovate, acute, deep yellow; **Fil** glabrous.

A. appendiculatum Bañares (Willdenowia 29(1): 98-101, ill., 1999). **T:** Canary Islands, Gomera (*Bañares & Marrero* 39570 [TFC, BJ]). – **D:** Canary Islands (Gomera); 100 - 900 m.

[4] Perennial monocarpic unbranched subshrubs to 1 m tall; **Br** to 9 cm $\varnothing$, smooth, grey; **Ros** 30 - 35 cm $\varnothing$, rather flat; **L** 11 - 20 $\times$ 2.5 - 4 cm, 3 - 5 mm thick, oblanceolate to subobovate, apically attenuate, strongly apiculate and usually mucronate, basally cuneate, glaucous, glabrous, margins with unicellular cilia (to 0.5 mm); **Inf** dome-shaped, 25 - 40 $\times$ 20 - 30 cm; **Fl** 8-merous, to 1.4 cm $\varnothing$, **Ped** 1.5 - 3 mm, glabrous; **Sep** glabrous; **Pet** 6 - 7 $\times$ 2 - 2.5 mm, lanceolate, white and often pinkish variegated; **Fil** glabrous, white; **Ca** glabrous.

Closely related to *A. urbicum* from Tenerife.

A. arboreum (Linné) Webb & Berthelot (Phytogr. Canar. 3(2:1): 185, 1840). **T:** [lecto]: Hort. Sicc. J. Burseri XVI(1): 52 (UPS: IDC 1064.114:III.4). – **D:** Canary Islands; as neophyte in the Mediterranean.

$\equiv$ *Sempervivum arboreum* Linné (1753) $\equiv$ *Sedum arboreum* (Linné) Hegi (1921) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum mutabile* W. Schlecht ex Breiter (1817); **incl.** *Aeonium manriqueorum* Bolle (1859) $\equiv$ *Sempervivum manriqueorum* (Bolle) Christ (1888).

A. arboreum var. **arboreum** – **D:** Canary Islands (Gran Canaria); 200 - 1200 m.

[1] Perennial few-branched subshrubs to 2 m; **Br** $\pm$ erect or ascending, often in groups, 1 - 3 cm $\varnothing$, smooth, without reticulations; **Ros** 10 - 25 cm $\varnothing$ (much smaller during the dry season), centre flattened with young leaves tightly appressed to each other; **L** 5 - 15 $\times$ 1 - 4.5 cm, 1.5 - 3 mm thick, obovate to oblanceolate, apically acuminate, basally cuneate, glossy, glabrate, green, usually purplish variegated, margin with curved cilia; **Inf** ovoid, 10 - 25 $\times$ 10 - 15 cm; peduncle 5 - 20 cm; **Ped** 2 - 12 mm, puberulent; **Fl** 9- to 11-merous; **Sep** pubescent; **Pet** 5 - 7 $\times$ 1.5 - 2 mm, narrowly oblong to lanceolate, acuminate, yellow; **Fil** glabrous.

Various cultivars are quite common in cultivation: *A. arboreum* cv. Zwartkop, *A. arboreum* fa. *foliis purpureis*, *A. arboreum* fa. *foliis variegatis*, *A. arboreum* var. *albovariegatum*, *A. arboreum* var. *atropurpureum*, *A. arboreum* var. *luteovariegatum*, *A. arboreum* var. *variegatum*.

A. arboreum var. **holochrysum** H.-Y. Liu (Syst. Aeonium, 67, 1989). **T:** [icono]: Lindley, Bot. Reg. 1835: t. 1741. – **D:** Canary Islands (Tenerife, Gomera, La Palma, Hierro); to 1500 m. **Fig. II.b**

Incl. *Sempervivum urbicum* Lindley (1835) (*nom. illeg.*, Art. 53.1); **incl.** *Aeonium vestitum* Sventenius (1960); **incl.** *Aeonium holochrysum* Webb & Berthelot (1840).

[1] Differs from var. *arboreum*: **Inf** ovoid or conical, 7 - 30 cm long; **Ped** glabrate; **Sep** glabrous; **Pet** yellow.

A. arboreum var. **rubrolineatum** (Sventenius) H.-Y. Liu (Syst. Aeonium, 68, 1989). **T:** Canary Islands, Gomera (*Sventenius* s.n. [ORT]). – **D:** Canary Islands (Gomera); to 1200 m. **Fig. III.a**

≡ *Aeonium rubrolineatum* Sventenius (1950).

[1] Differs from var. *arboreum*: **Inf** semiglobose to ovoid, 8 - 15 cm long; **Ped** glabrate; **Sep** glabrous; **Pet** rather pale yellow, commonly striped with reddish.

A. aureum (C. Smith ex Hornemann) Mes (in 't Hart & Eggli (eds.), Evol. Syst. Crassulaceae, 41, 1995). – **D:** Canary Islands (Gran Canaria, Tenerife, Gomera, La Palma, Hierro); 400 - 2000 m. **Fig. II.c**

≡ *Sempervivum aureum* C. Smith ex Hornemann (1819) ≡ *Greenovia aurea* (C. Smith ex Hornemann) Webb & Berthelot (1840); **incl.** *Sempervivum calyciforme* Haworth (1819); **incl.** *Greenovia ferrea* Webb in Christ (1888) ≡ *Sempervivum ferreum* (Webb) Christ (1888); **incl.** *Greenovia polypharmica* Webb in Christ (1888) ≡ *Sempervivum polypharmicum* (Webb) Christ (1888); **incl.** *Greenovia rupifraga* Webb in Christ (1888) ≡ *Sempervivum rupifragum* (Webb) Christ (1888).

[3] Monocarpic perennials; **Ros** solitary or occasionally offsetting, 8 - 25 cm, cup-shaped with the inner **L** erect, tightly closed during the dry season; **L** 5 - 11 × 3 - 6 cm, obovate-spatulate, apically rounded, truncate or broadly cuneate, minutely apiculate or retuse, basally broadly cuneate, glabrous, glaucous, margin hyaline and occasionally with some minute glandular **Ha**, pale green; **Inf** flat-topped, 10 - 25 × 20 - 45 cm; peduncle 15 - 35 cm, densely leafy; **Ped** 2 - 5 mm, pubescent; **Fl** 25- to 32-merous; **Sep** puberulent or pubescent; **Pet** 7 - 8 × 1.5 - 2 mm, oblanceolate, acuminate, often apiculate, deep yellow; **Fil** glabrous.

A. balsamiferum Webb & Berthelot (Phytogr. Canar. 1: 192, 1840). **T:** Canary Islands, Lanzarote (*Anonymus* s.n. [FI]). – **D:** Canary Islands (N and C Lanzarote, naturalized in Fuerteventura).

≡ *Sempervivum balsamiferum* (Webb & Berthelot) Webb ex Christ (1888).

[1] Perennial rather few-branched subshrubs to 1.5 m, with resinous scent; **Br** ± erect or ascending, often in groups, 8 - 20 mm Ø, glabrous, smooth,

without reticulations; **Ros** 7 - 18 cm Ø, center flattened with young **L** tightly appressed to each other; **L** 3 - 7 × 1.5 - 3.5 cm, 1.5 - 3 mm thick, narrowly obtrullate to obtrullate-spatulate, apically mucronate, basally cuneate, glabrous, margin with curved cilia (0.5 - 1 mm), greyish green, occasionally with some brownish stripes along the margin; **Inf** 15 - 25 × 14 - 20 cm; peduncle 8 - 15 cm; **Ped** 2 - 12 mm, glabrous; **Fl** 7- to 8-merous; **Sep** glabrous; **Pet** 6 - 8 × 1.2 - 1.5 mm, lanceolate, acuminate, yellow; **Fil** glabrous.

A. canariense (Linné) Webb & Berthelot (Phytogr. Canar. 3(2:1): 196, 1841). **T:** [lecto - icono]: Commelin, Hort. Med. Amstel. 2: 189, t. 95, 1687. – **D:** Canary Islands.

≡ *Sempervivum canariense* Linné (1753).

A. canariense var. **canariense** – **D:** Canary Islands (N Tenerife); 600 - 1300 m. **Fig. II.d**

Incl. *Sempervivum latifolium* Salisbury (1796) (*nom. illeg.*, Art. 52.1); **incl.** *Aeonium giganteum* Webb ex Christ (1888); **incl.** *Sempervivum canariense* ssp. *typicum* Burchard (1929) (*nom. inval.*, Art. 24.3).

[5] Perennials; **Ros** solitary or caespitose; stems stout, smooth; **Ros** 10 - 60 cm Ø, cup-shaped, inner **L** ± erect; **L** 6 - 35 × 3 - 12 cm, 3 - 10 mm thick, obovate to oblanceolate, apically rounded, mucronate, basally cuneate, velvety with glandular **Ha** 0.7 - 1 (- 1.4) mm (5 - 15 **Ha** per mm²), margin occasionally slightly undulate, green, occasionally reddish or yellowish; **Inf** 30 - 45 × 20 - 30 cm; peduncle 12 - 30 cm, leafy; **Ped** 0.5 - 5 mm, pubescent; **Fl** 8- to 10-merous; **Sep** glandular-pubescent; **Pet** 7 - 9 × 1.5 - 2 mm, narrowly elliptic, whitish-green; **Fil** glabrous.

A. canariense var. **palmense** (Webb ex Christ) H.-Y. Liu (Syst. Aeonium, 57, 1989). **T** [lecto]: Canary Islands, La Palma (*Anonymus* s.n. [FI, FI]). – **D:** Canary Islands (La Palma, N Hierro); to 1200 m.

≡ *Aeonium palmense* Webb ex Christ (1888) ≡ *Sempervivum palmense* (Webb ex Christ) Christ (1888) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum xchristii* Praeger (1925) (*nom. illeg.*, Art. 53.1) ≡ *Sempervivum canariense* ssp. *christii* (Praeger) Burchard (1929); **incl.** *Sempervivum canariense* ssp. *longithyrsum* Burchard (1929) ≡ *Aeonium longithyrsum* (Burchard) Sventenius (1969); **incl.** *Sempervivum propinquum* Praeger (1932).

[5] Differs from var. *canariense*: **Ros** cup-shaped; **L** velvety with glandular **Ha** 0.3 - 0.5 (- 1) mm (30 - 60 **Ha** per mm²), viscid, margin often strongly undulate; **Inf** 40 - 60 × 15 - 30 cm; **Fl** 8- to 10-merous; **Pet** 7 - 10 × 2 - 3 mm, lanceolate, yellowish-green.

A. canariense var. **subplanum** (Praeger) H.-Y. Liu (Syst. Aeonium, 59, 1989). **T** [lecto]: Canary Is-

lands, Gomera (*Praeger* s.n. [K]). – **D:** Canary Islands (Gomera); 200 - 1000 m.

≡ *Aeonium subplanum* Praeger (1928); **incl.** *Sempervivum canariense* ssp. *latifolium* Burchard (1929).

[5] Differs from var. *canariense*: **Ros** often flat-tish; **L** velvety with glandular **Ha** 0.3 - 1 mm (5 - 15 **Ha** per mm²); **Inf** 18 - 30 × 15 - 28 cm; **Fl** 10- to 12-merous; **Pet** 7 - 10 × 2 - 2.5 mm, lanceolate, greenish-yellow.

A. canariense var. *virginum* (Webb ex Christ) H.-Y. Liu (Syst. Aeonium, 60, 1989). **T** [lecto]: Canary Islands, Gran Canaria (*Bourgeau* 356 [FI, BM, CGE, E, FI, G, GH, K, LE, MO, WRSL]). – **D:** Canary Islands (N Gran Canaria); to 1000 m.

≡ *Aeonium virginum* Webb ex Christ (1888) ≡ *Sempervivum virginum* (Webb ex Christ) Christ (1888) ≡ *Sempervivum canariense* ssp. *virginum* (Webb ex Christ) Burchard (1929).

[5] Differs from var. *canariense*: **Ros** cup-shaped; **L** velvety with glandular **Ha** 0.6 - 0.9 mm (10 - 20 **Ha** per mm²), margin occasionally undulate; **Inf** 15 - 45 × 12 - 30 cm; **Fl** 6- to 9-merous; **Pet** 7 - 8.5 × 1.5 - 2 mm, lanceolate, yellowish-green.

A. castello-paivae Bolle (Bonplandia 7: 240, 1859). **T:** Canary Islands, Gomera (*Bolle* s.n. [B?]). – **D:** Canary Islands (Gomera); 200 - 900 m.

≡ *Sempervivum castello-paivae* (Bolle) Christ (1888); **incl.** *Sempervivum paivae* Lowe (1866) ≡ *Aeonium paivae* (Lowe) Lemaire (1869).

[4] Perennial densely branched shrublets to 70 cm; **Br** ascending or pendent, tortuous, 3 - 8 mm Ø, puberulent, smooth; **Ros** 3 - 7 cm Ø, flattish, inner **L** ± erect; **L** 1.5 - 3.5 × 0.8 - 2 cm, 2 - 3 mm thick, obovate-spatulate, apically acuminate to caudate, basally cuneate, glaucous, glabrate, pale green to yellowish green, generally variegated with few reddish stripes, margin occasionally with some rather straight cilia (< 0.2 mm), often slightly longitudinally folded; **Inf** lax, semiglobose, 6 - 20 × 6 - 20 cm; peduncle 7 - 25 cm; **Ped** 1 - 2 mm, puberulent; **Fl** 7- to 9-merous; **Sep** puberulent; **Pet** 8 - 10 × 1 - 1.5 mm, lanceolate, acuminate, greenish-white; **Fil** puberulent.

A. ciliatum Webb & Berthelot (Phytogr. Canar. 1: 195, 1841). **T:** Canary Islands, Tenerife (*Broussonet* s.n. [B, LE]). – **Lit:** Bañares Baudet & Catalina León (1997: with ill.). **D:** Canary Islands (N Tenerife); 200 - 1000 m.

Incl. *Sempervivum ciliatum* Willdenow (1809) (*nom. illeg.*, Art. 53.1).

[4] Perennial few-branched subshrubs to 1 m; **Br** ascending, 5 - 20 mm Ø, glabrous, reticulate; **Ros** 8 - 20 cm Ø, rather flattish; **L** 4 - 12 × 2 - 5 cm, 4 - 8 mm thick, obovate-spatulate, apically acute, basally attenuate or cuneate, glaucous, glabrate, dark green

to yellowish-green, occasionally slightly folded longitudinally near the apex, margin with straight or slightly curved cilia 0.4 - 0.8 mm; **Inf** dome-shaped, 15 - 40 × 10 - 35 cm; peduncle 5 - 20 cm; **Ped** 2 - 4 mm, puberulent; **Fl** 7- to 9-merous; **Sep** puberulent; **Pet** 7 - 10 × 1.2 - 2 mm, lanceolate, acuminate, whitish, lower face often greenish variegated; **Fil** sparsely puberulent.

Easily confused with *A. davidbramwellii* (Bañares Baudet & Catalina León 1997).

A. cuneatum Webb & Berthelot (Phytogr. Canar. 1: 197, 1841). **T:** Canary Islands (*Anonymus* s.n. [not located]). – **D:** Canary Islands (E and W Tenerife); 500 - 950 m, laurel forest region in fairly humid habitats.

≡ *Sempervivum cuneatum* (Webb & Berthelot) Webb ex Christ (1888).

[5] Perennials, **Ros** solitary or occasionally offsetting; stem stout, glabrous, smooth; **Ros** 15 - 50 cm Ø, cup-shaped, inner **L** generally tightly appressed to each other; **L** 10 - 25 × 5 - 8 cm, 5 - 9 mm thick, obovate or obovate-spatulate, apically acute, mucronate, basally cuneate, glabrate, margin with conical cilia (≤ 0.4 mm), occasionally slightly undulate; **Inf** 18 - 60 × 12 - 30 cm; peduncle 15 - 50 cm, leafy; **Ped** 1 - 6 mm, puberulent; **Fl** 8- to 9-merous; **Sep** puberulent; **Pet** 6.5 - 7.5 × 1.3 - 1.6 mm, oblanceolate, acuminate, yellow; **Fil** glabrous.

A. davidbramwellii H.-Y. Liu (Syst. Aeonium, 88-89, ill., 1989). **T:** Canary Islands, La Palma (*Liu* 3261A [OS]). – **D:** Canary Islands (La Palma); to 1000 m. **Fig. II.e**

Incl. *Aeonium ciliatum* ssp. *praegeri* Bañares (1990).

[4] Perennial few-branched subshrubs to 1 m; **Br** ascending, 7 - 25 mm Ø, glabrous, reticulate; **Ros** 6 - 22 cm Ø, rather flattish; **L** 3 - 12 × 2 - 4 cm, 2 - 6 mm thick, obovate to oblanceolate-spatulate, apically acuminate, basally attenuate or cuneate, puberulent, margin with conical cilia (≤ 0.5 mm), dark green to yellowish-green, often reddish or brownish variegated along margin; **Inf** ± ovoid, 10 - 35 × 8 - 25 cm; peduncle 5 - 20 cm long; **Ped** 1 - 3 mm, puberulent; **Fl** 6- to 8-merous; **Sep** puberulent; **Pet** 6.5 - 9 × 1.5 - 2.5 mm, lanceolate, acuminate, whitish, generally greenish variegated; **Fil** puberulent.

Easily confused with *A. ciliatum* (Bañares Baudet & Catalina León 1997).

A. decorum Webb ex Bolle (Bonplandia 7: 240, 1859). **T** [lecto]: Canary Islands, Gomera (*Bourgeau* 141 [FI, BG, BM, G, K, LE, LY, WRSL]). – **D:** Canary Islands (Gomera, Tenerife); 100 - 900 m.

≡ *Sempervivum decorum* (Webb ex Bolle) Christ (1888).

[4] Perennial densely branched shrublets to 60 cm; **Br** ascending or pendent, tortuous, 5 - 8 mm Ø, glabrous, reticulate; **Ros** 5 - 10 cm Ø, rather flat-

tish; **L** 2.5 - 5 × 1 - 1.5 cm, 2.5 - 4.5 mm thick, obovate to oblanceolate, apically acuminate, basally cuneate, glaucous, puberulent, margin with few scattered cilia (≤ 0.5 mm), dark green to yellowish-green, often reddish variegated along margin; **Inf** lax, cylindrical, 8 - 30 × 8 - 20 cm; peduncle 10 - 30 cm; **Ped** 2 - 10 mm, puberulent; **Fl** 6- to 8-merous; **Sep** puberulent; **Pet** 7 - 8 × 2 - 2.5 mm, lanceolate, acuminate, whitish, often pinkish or reddish variegated; **Fil** sparsely puberulent.

Recently also reported from Tenerife (Hernández 1998).

A. diplocyclum (Webb ex Bolle) Mes (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 41, 1995). – **D**: Canary Islands (Gomera, La Palma, Hierro); 50 - 1700 m.

≡ *Greenovia diplocycla* Webb ex Bolle (1859) ≡ *Sempervivum diplocyclum* (Webb ex Bolle) Christ (1888).

[3] Perennial solitary monocarpic **Ros** 6 - 18 cm Ø, cup-shaped with inner **L** erect, tightly closed during the dry season; **L** 5 - 8 × 4 - 6.5 cm, obovate-spatulate, apically rounded, truncate or broadly cuneate, apiculate or rarely retuse, basally broadly cuneate, glabrous, glaucous, margin hyaline, occasionally sparsely glandular-hairy, often minutely erose or sinuate, pale green; **Inf** flat-topped, floriferous part 13 - 16 × 15 - 20 cm; peduncle 8 - 22 cm, densely leafy; **Ped** 2 - 4 mm, glandular-hairy; **Sep** glandular-hairy; **Fl** 19- to 24-merous; **Pet** 5 - 6 × 1 - 1.5 mm, lanceolate, acuminate, often apiculate, deep yellow; **Fil** glabrous.

Hardly different from *A. aureum*. This species group (including *A. dodrantale*) is not yet satisfactorily resolved.

A. dodrantale (Willdenow) Mes (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 41, 1995). **T**: Canary Islands, Tenerife (*Broussonet* s.n. [B]). – **D**: Canary Islands (E and W Tenerife); 150 - 1200 m. **Fig. II.f**

≡ *Sempervivum dodrantale* Willdenow (1809) ≡ *Greenovia dodrantalis* (Willdenow) Webb & Berthelot (1840); **incl.** *Greenovia gracilis* Bolle (1859) ≡ *Sempervivum gracile* (Bolle) Christ (1888).

[3] Perennial densely offsetting **Ros**, offsets on a stalk 2 - 8 cm long, slender, smooth; **Ros** 3 - 6 cm Ø, cup- or urn-shaped, **L** densely packed even when growing, tightly closed during the dry season; **L** 2 - 3.5 × 1 - 1.5 cm, 1 - 2 mm thick, obovate-spatulate, apically rounded or truncate, often retuse, basis broadly cuneate or slightly attenuate, glaucous, often very finely glandular-hairy when young, later glabrous, margin hyaline, pale green; **Inf** flat-topped, floriferous part 3 - 6 × 5 - 10 cm, rather few-flowered; peduncle 10 - 25 cm, densely leafy; **Ped** 2 - 4 mm, glandular-pubescent; **Fl** 18- to 23-merous; **Sep** glandular-pubescent; **Pet** 6 - 7 × 1 - 1.5 mm, oblanceolate, acute, deep yellow; **Fil** glabrous.

A. glandulosum (Aiton) Webb & Berthelot (*Phytogr. Canar.* 3(2:1): 185, 1840). **T**: Madeira (*Masson* s.n. [not located]). – **D**: N Madeira (Deserta Grande), to 1500 m. **Fig. II.g**

≡ *Sempervivum glandulosum* Aiton (1789); **incl.** *Aeonium meyerheimii* Bolle (1859) ≡ *Sempervivum meyerheimii* (Bolle) Murray (1899); **incl.** *Sempervivum patina* Lowe (1864) (*nom. inval.*, Art. 34.1).

[5] Biennial to perennial, single or occasionally offsetting **Ros** plants; stems stout, smooth; **Ros** 12 - 40 cm Ø, cup-shaped; **L** 6 - 11 × 3 - 8 cm, 3 - 5 mm thick, obovate or oblanceolate, puberulent, tip acute, mucronulate, basally cuneate, margin with bead-shaped cilia (≤ 0.6 mm); **Inf** much wider than tall, 8 - 25 × 12 - 40 cm; peduncle 2 - 10 cm, leafy; **Ped** 3 - 18 mm, glandular-pubescent; **Fl** 8- to 13-merous; **Sep** glandular-pubescent; **Pet** 7 - 11 × 3 - 4 mm, lanceolate, acute, pale yellow; **Fil** glabrous.

A. glutinosum (Aiton) Webb & Berthelot (*Phytogr. Canar.* 3(2:1): 185, 1840). **T**: Madeira (*Masson* s.n. [BM]). – **D**: N Madeira (Deserta Grande); to 300 (rarely 1700) m. **Fig. II.h**

≡ *Sempervivum glutinosum* Aiton (1789).

[5] Perennial caespitose or slightly shrubby **Ros** plants; **Br** 7 - 20 mm Ø, glabrous, sticky, smooth; **Ros** 12 - 22 cm Ø, cup-shaped; **L** 7 - 12 × 3 - 5.5 cm, 2 - 4.5 mm thick, obovate-spatulate, apically acute, basally cuneate, glabrate, margin with very few to numerous straight to curved cilia (≤ 0.5 mm), pale to dull green, usually with brownish stripes along the midrib and near the apex; **Inf** very lax, sticky, 15 - 40 × 15 - 30 cm; peduncle 10 - 25 cm long; **Ped** 2 - 10 mm, puberulent; **Fl** 8- to 10-merous; **Sep** puberulent; **Pet** 5 - 7 × 2 - 3 mm, ovate to lanceolate, yellow, lower face with reddish lines; **Fil** glabrous.

A. gomerense (Praeger) Praeger (*J. Bot.* 66: 222, 1928). **T**: Canary Islands, Gomera (*Praeger* s.n. [not located]). – **D**: Canary Islands (Gomera); 500 - 1100 m.

≡ *Sempervivum gomerense* Praeger (1925).

[4] Perennial loosely branched subshrubs to 2 m; **Br** ascending or pendent, 3 - 15 mm Ø, glabrous, reticulate; **Ros** 10 - 28 cm Ø, rather flattish; **L** 5 - 14 × 2.5 - 4 cm, 3 - 7 mm thick, obovate to oblanceolate, apically acuminate, basally cuneate, glabrate, slightly glaucous, margin with $\pm$ straight cilia (0.5 - 1 mm), green, often reddish variegated along the margin; **Inf** $\pm$ ovoid, 15 - 40 × 10 - 30 cm; peduncle 10 - 20 cm; **Ped** 2 - 6 mm, glabrous; **Fl** 7- to 9-merous; **Sep** glabrous; **Pet** 8 - 10 × 1.5 - 2 mm, lanceolate, acuminate, whitish, lower face greenish variegated; **Fil** glabrous.

A. goochiae Webb & Berthelot (*Phytogr. Canar.* 1: 190, 1840). **T** [lecto]: Canary Islands, La Palma (*Anonymus* s.n. [FI, FI, K]). – **D**: Canary Islands (N La Palma); 100 - 700 m.

≡ *Sempervivum goochiae* (Webb & Berthelot)

Christ (1888) $\equiv$ *Sempervivum tortuosum* var. *goochiae* (Webb & Berthelot) Kuntze (1891) $\equiv$ *Aldasorea goochiae* (Webb & Berthelot) hort. ex Haage & Schmidt (1930).

[2] Perennial densely branched shrublets to 40 cm tall; **Br** 2 - 10 mm Ø, pubescent, slightly viscid, smooth, without reticulations; **Ros** 3 - 12 cm Ø, flattish, inner **L** $\pm$ erect; **L** 1.5 - 5 $\times$ 1.5 - 2.5 cm, 1 - 2 mm thick, elliptic or circular, apically rounded or acute, retuse, basally cuneate, pubescent, viscid, pale green to yellowish green, occasionally reddish variegated; **Inf** cymose panicles 2 - 5 $\times$ 3 - 11 cm, commonly 10- to 45-flowered; peduncle 1 - 2 cm; **Ped** 1 - 15 mm, puberulent; **Fl** 7- to 8-merous; **Sep** glandular-pubescent; **Pet** 5 - 7 $\times$ 1 - 2 mm, oblanceolate, acute, very pale yellow or whitish, median part often pinkish variegated; **Fil** glabrous.

A. gorgoneum J. A. Schmidt (Beitr. Fl. Cap Verd. Ins., 258, 1852). **T:** Cape Verde Islands (*Schmidt* s.n. [not located]). – **D:** Cape Verde Islands (San Antonio, San Nicolau, San Vicente); $\pm$ 300 - 1300 m.

$\equiv$ *Sempervivum gorgoneum* (J. A. Schmidt) J. A. Schmidt ex Coutinho (1914).

[1] Perennial branched subshrubs to 2 m; **Br** ascending, usually in groups, 5 - 15 mm Ø, glabrous, smooth; **Ros** 9 - 20 cm Ø, centre rather flattened with young **L** tightly appressed to each other; **L** 5 - 10 $\times$ 1.5 - 3 cm, 3 - 6 mm thick, oblanceolate-spatulate, apically acute or acuminate, mucronate, basally cuneate, strongly glaucous, glabrous, margin with straight or forward-curved cilia ($\leq$ 0.5 mm), green, often reddish variegated along margin and midrib; **Inf** pyramidal, 5 - 8 $\times$ 7 - 10 cm; peduncle 5 - 8 cm; **Ped** 1 - 8 mm, glabrous; **Fl** 8- to 10-merous; **Sep** glabrous; **Pet** 5 - 6 $\times$ 1 - 1.5 mm, lanceolate, acuminate, yellow, reddish variegated; **Fil** glabrous.

A. haworthii Salm-Dyck ex Webb & Berthelot (Phytogr. Canar. 3(2:1): 193, 1840). **T:** Canary Islands, Tenerife (*Anonymus* s.n. [not located]). – **D:** Canary Islands (N Tenerife: Anaga, Teno); to 1000 m. **Fig. III.b**

$\equiv$ *Sempervivum haworthii* (Webb & Berthelot) Salm-Dyck ex Christ (1888); **incl.** *Aeonium volkeri* E. Hernández & Bañares (1996).

[4] Perennial densely branched shrublets to 60 cm; **Br** ascending or pendent, tortuous, 3 - 6 mm Ø, glabrate, $\pm$ reticulate; **Ros** 6 - 11 cm Ø, rather flattish, inner **L** $\pm$ erect; **L** 3 - 5.5 $\times$ 1.5 - 3 cm, 2.5 - 4 mm thick, obovate, apically acute, caudate, basally cuneate, often rather strongly glaucous, glabrate, margin with curved cilia (0.4 - 0.8 mm), green or yellowish green, often reddish variegated; **Inf** lax, semiglobose, 6 - 16 $\times$ 6 - 16 cm; peduncle 1 - 9 cm; **Ped** 2 - 12 mm, glabrous; **Fl** 7- to 9-merous; **Sep** glabrous; **Pet** 7 - 9 $\times$ 1.2 - 1.8 mm, lanceolate, acuminate, pale yellow to whitish, pinkish variegated; **Fil** glabrate to sparsely puberulent.

A. hierrense (R. P. Murray) Pitard & Proust (Îles Canaries, 191, 1909). **T** [lecto]: Canary Islands, Hierro (*Murray* s.n. [K, BM]). – **D:** Canary Islands (La Palma, Hierro); to 1200 m. **Fig. III.c**

$\equiv$ *Sempervivum hierrense* R. P. Murray (1899).

[4] Perennial, unbranched or rarely few-branched, monocarpic subshrubs to 1.5 m; **Br** ascending, 20 - 45 mm Ø, glabrous, reticulate; **Ros** 15 - 60 cm Ø, flattish; **L** 8 - 30 $\times$ 5 - 8 cm, 3 - 7 mm thick, obovate or oblanceolate, apically acute, caudate and often recurved, basally cuneate, strongly glaucous, glabrate, margin with slightly curved cilia (1 - 2 mm), green, with reddish or pinkish variegated margin; **Inf** dome-shaped, 15 - 50 $\times$ 12 - 50 cm; peduncle 5 - 25 cm; **Ped** 2 - 6 mm, puberulent; **Fl** 6- to 9-merous; **Sep** puberulent; **Pet** 7 - 9 $\times$ 1.5 - 2 mm, lanceolate, acuminate, whitish, median part often pinkish variegated; **Fil** puberulent.

A. korneliuslemsii H.-Y. Liu (Syst. Aeonium, 63, 1989). **T:** Morocco (*Gattefossé* s.n. [MO, K]). – **D:** SW Morocco. **I:** Jonkers (2001: as *A. arboreum*).

[1] Perennial rather few-branched subshrubs to 1.5 m; **Br** $\pm$ erect to ascending, often in groups, 10 - 20 mm Ø, glabrous, smooth; **Ros** 5 - 17 cm Ø, centre flattish with young inner **L** tightly appressed to each other; **L** 4 - 9 $\times$ 2 - 3 cm, 1.5 - 3 mm thick, obovate or obovate-spatulate, apically truncate or rounded, basally cuneate, puberulent, margin with straight or curved cilia (0.4 - 1 mm), pale green to yellowish-green; **Inf** 5 - 20 $\times$ 5 - 18 cm; peduncle 10 - 13 cm long; **Ped** 3 - 8 mm, puberulent; **Fl** 7- to 9-merous; **Sep** sparsely puberulent to puberulent; **Pet** 4.5 - 6 $\times$ 1.5 - 2.5 mm, elliptic, acute, occasionally emarginate, yellow; **Fil** glabrous.

A. lancerottense (Praeger) Praeger (J. Bot. 66: 222, 1928). **T:** Canary Islands, Lanzarote (*Praeger* s.n. [not located]). – **D:** Canary Islands (Lanzarote); 200 - 600 m.

$\equiv$ *Sempervivum lancerottense* Praeger (1925).

[1] Perennial densely branched subshrubs to 60 cm; **Br** ascending, 7 - 15 mm Ø, glabrous, reticulate; **Ros** 10 - 18 cm Ø, rather flattish; **L** 5 - 9 $\times$ 1.5 - 4 cm, 3 - 6 mm thick, obovate- or oblanceolate-spatulate, apically acute, caudate, basally cuneate, glaucous, glabrate, margin with some wrinkled cilia in the upper part, green to yellowish-green, often reddish variegated along margin and at the apex; **Inf** dome-shaped, 8 - 30 $\times$ 8 - 25 cm; peduncle 6 - 20 cm; **Ped** 1 - 3.5 mm, glabrous; **Fl** 7- to 8-merous; **Sep** puberulent to glabrate; **Pet** 6 - 9 $\times$ 1 - 1.5 mm, lanceolate, acuminate, whitish, median part pinkish variegated; **Fil** glabrous.

A. leucoblepharum Webb ex A. Richard (Tent. Fl. Abyss. 1: 314, 1848). **T** [lecto]: Ethiopia (*Schimper* 838 [P, G, FI, K, LE, W]). – **D:** Yemen, E Africa (Ethiopia, Somalia, Kenya, Uganda); $\pm$ 2000 - 3500 m.

≡ *Sempervivum leucoblepharum* (Webb ex A. Richard) Hutchison & E. A. Bruce (1941); **incl.** *Sempervivum chrysanthum* Hochstetter ex Britten (1871) (*nom. illeg.*, Art. 52.1) ≡ *Aeonium chrysanthum* (Hochstetter ex Britten) A. Berger (1930); **incl.** *Sempervivum chrysanthum* var. *glabrum* Chiovenda (1919); **incl.** *Sempervivum chrysanthum* var. *glandulosum* Chiovenda (1919) ≡ *Aeonium leucoblepharum* var. *glandulosum* (Chiovenda) Cufodontis (1969).

[1] Perennial branched subshrubs to 2 m; **Br** ascending to decumbent, usually in groups, 7 - 20 mm Ø, glabrous, smooth; **Ros** 10 - 20 cm Ø, centre flattened; **L** 5 - 12 × 1.5 - 3.5 cm, 2 - 5 mm thick, oblanceolate- to obovate-spatulate, apically acuminate, basally cuneate, margin with straight or curved cilia (0.4 - 1 mm), glabrate, yellowish-green to dark green, usually reddish variegated along margin; **Inf** ovoid to dome-shaped, 8 - 18 × 8 - 15 cm; peduncle 3 - 15 cm; **Ped** 1 - 6 mm, puberulent; **Fl** 7- to 10-merous; **Sep** sparsely puberulent; **Pet** 6 - 8 × 1.8 - 2.5 mm, elliptic or lanceolate, retuse, yellow, occasionally reddish variegated; **Fil** glabrous to sparsely puberulent.

A. lindleyi Webb & Berthelot (Phytogr. Canar. 1: 189, 1840). **T:** Canary Islands, Tenerife (*Anonymus* s.n. [FI, OS [photo]]). – **D:** Canary Islands.

≡ *Sempervivum lindleyi* (Webb & Berthelot) Webb ex Christ (1888) ≡ *Sempervivum tortuosum* var. *lindleyi* (Webb & Berthelot) Kuntze (1891).

A. lindleyi var. *lindleyi* – **D:** Canary Islands (NE Tenerife); to 1000 m but most common between 200 and 500 m. **Fig. III.d**

[2] Perennial densely branched shrublets to 50 cm; **Br** 3 - 15 mm Ø, puberulent, viscid, smooth, without reticulations; **Ros** 4 - 9 cm Ø, rather flattish, inner **L** ± erect; **L** 2 - 4.5 × 0.6 - 1.6 cm, 5 - 7 mm thick, obovate or obovate-spatulate, apically obtuse, acute, or attenuate, basally cuneate or attenuate, puberulent to distinctly pubescent, viscid, yellowish-green to dark green; **Inf** cymose panicles, floriferous part 2 - 7 × 3 - 9 cm; peduncle 1 - 9 cm; **Ped** 1 - 10 mm, puberulent; **Fl** 8- to 9-merous; **Sep** pubescent; **Pet** 5 - 7 × 1.5 - 2 mm, narrowly elliptic or lanceolate, acuminate, yellow; **Fil** glabrous.

A. lindleyi var. *viscatum* (Bolle) H.-Y. Liu (Syst. Aeonium, 41, 1989). **T** [lecto]: Canary Islands, Gomera (*Bourgeau* 736 [FI, G]). – **D:** Canary Islands (E Gomera); ± 100 - 900 m.

≡ *Aeonium viscatum* Bolle (1859) ≡ *Sempervivum viscatum* (Bolle) Christ (1888) ≡ *Sempervivum tortuosum* var. *viscatum* (Bolle) Kuntze (1891).

[2] Differs from var. *lindleyi*: **L** 3 - 4 mm thick, with a dense covering of extremely short multicellular **Ha** (≤ 0.04 mm); **Fl** 7- to 9-merous; **Pet** 5 - 7 × 1 - 1.5 mm, lanceolate, acuminate.

A. nobile (Praeger) Praeger (J. Bot. 66: 221, 1928). **T:** Canary Islands, La Palma (*Praeger* s.n. [US [status ?, ex cult. 1928]]). – **D:** Canary Islands (La Palma); to 750 m. **Fig. III.e**

≡ *Sempervivum nobile* Praeger (1925).

[4] Perennial robust monocarpic solitary **Ros**; stems rather stout, 1 - 3 cm Ø, glabrous, ± smooth; **Ros** 25 - 80 cm Ø, broadly cup-shaped to rather flattish, with inner **L** ± erect; **L** 7 - 50 × 4 - 30 cm, 6 - 18 mm thick, obovate, apically acute or acuminate, basally attenuate or occasionally cuneate, often longitudinally folded, glabrate, often viscid when young, lower part of margin occasionally with some few scattered cilia (≤ 0.5 mm), yellowish-green, occasionally reddish or brownish variegated esp. along the margin; **Inf** flat-topped to broadly dome-shaped, 20 - 40 × 30 - 60 cm; peduncle 2 - 5 cm; **Ped** 1 - 2 mm, puberulent; **Fl** 7- to 9-merous; **Sep** puberulent; **Pet** 3 - 5 × 1 - 1.5 mm, lanceolate, acuminate, whitish, intensely reddish variegated; **Fil** glabrous.

A. percarneum (R. P. Murray) Pitard & Proust (Îles Canaries, 191, 1909). **T** [lecto]: Canary Islands, Gran Canaria (*Murray* s.n. [BM, K]). – **D:** Canary Islands (Gran Canaria); ± 100 - 1300 m.

≡ *Sempervivum percarneum* R. P. Murray (1899) ≡ *Aldasorea percarnea* (Murray) hort. ex Haage & Schmidt (1930); **incl.** *Aeonium percarneum* var. *guiaense* G. Kunkel (1977).

[4] Perennial few-branched subshrubs to 1 m; **Br** ascending, 7 - 20 mm Ø, glabrous, reticulate; **Ros** 8 - 20 cm Ø, flattish; **L** 4.5 - 10 × 2 - 4 cm, 3 - 6 mm thick, obovate- to oblanceolate-spatulate, apically acute, caudate, basally cuneate, glaucous, glabrate, margin often weakly denticulate, often with curved cilia (≤ 1 mm), dark green, often reddish variegated along the margin; **Inf** dome-shaped, 10 - 30 × 10 - 25 cm; peduncle 8 - 20 cm; **Ped** 1 - 3 mm, puberulent; **Fl** 8- to 10-merous; **Sep** puberulent; **Pet** 7 - 8 × 1.2 - 1.8 mm, lanceolate, acuminate, whitish, median part pinkish variegated; **Fil** sparsely puberulent.

A. saundersii Bolle (Bonplandia 7: 241, 1859). **T:** Canary Islands, Gomera (*Anonymus* s.n. [not located]). – **D:** Canary Islands (Gomera); ± 150 - 800 m.

≡ *Sempervivum saundersii* (Bolle) Christ (1888) ≡ *Aldasorea saundersii* (Bolle) hort. ex Haage & Schmidt (1930).

[2] Perennial, densely branched shrublets to 30 cm, with distinct pleasant scent; **Br** 1 - 4 mm Ø, glabrate, slightly viscid, ± smooth; **Ros** 2.5 - 6 cm Ø, flattish, inner **L** ± erect, imbricate and forming a globose bud during the dry season; **L** 1.2 - 3.5 × 0.7 - 1.3 cm, 1.5 - 2.5 mm thick, elliptic to obovate, apically acute or rounded, retuse, cuneate or attenuate, pubescent, green to yellow-green, lower face reddish variegated; **Inf** lax, 3 - 8 × 2 - 15 cm, 5- to

70-flowered; peduncle 3 - 8 cm; **Ped** 3 - 12 mm, puberulent; **Fl** 12- to 16-merous; **Sep** puberulent; **Pet** 6 - 9 × 1.5 - 2.5 mm, oblanceolate, acuminate, yellow; **Fil** glabrous.

A. sedifolium (Webb ex Bolle) Pitard & Proust (Îles Canaries, 193, 1909). **T** [lecto]: Canary Islands, Tenerife (*Bourgeau* 741 [FI, BM, G, KJ]). – **D**: Canary Islands (Tenerife [Teno], N La Palma); to 1000 m.

≡ *Aichryson sedifolium* Webb ex Bolle (1859) ≡ *Greenovia sedifolium* (Webb ex Bolle) Webb ex Christ (1888) ≡ *Sempervivum sedifolium* (Webb ex Bolle) Christ (1888); **incl.** *Sempervivum masferrerii* Hillebrand (1881).

[2] Perennial densely branched shrublets to 40 cm; **Br** 1 - 5 mm Ø, sparsely puberulent, viscid, smooth, without reticulations; **Ros** 1.4 - 3 cm Ø, rather flattish, inner **L** ± erect, imbricate and forming a globose bud during the dry season; **L** 0.7 - 1.5 × 0.4 - 1 cm, 3 - 5 mm thick, ovate or obovate, glossy, puberulent, viscid, green to yellowish-green, lower face with reddish stripes, variegated with many brownish lines near the apex; **Inf** lax, floriferous part 2 - 7 × 2 - 5 cm, commonly 6- to 15-flowered; peduncle 2 - 8 cm; **Ped** 5 - 16 mm, puberulent; **Sep** puberulent; **Fl** 9- to 11-merous; **Pet** 5 - 7 × 2 - 2.5 mm, obovate or oblanceolate, acute or obtuse, yellow; **Fil** sparsely puberulent.

A. simsii (Sweet) Stearn (Gard. Chron., ser. 3, 130: 169, 1951). **T**: [lecto – icono]: Sweet, Hort. Suburb. Lond, ill. p. 230. – **D**: Canary Islands (Gran Canaria); 500 - 1900 m.

≡ *Sempervivum simsii* Sweet (1818); **incl.** *Sempervivum ciliatum* Sims (1818) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum barbatum* C. Smith ex Hornemann (1819); **incl.** *Sempervivum caespitosum* C. Smith ex Otto (1820) (*nom. illeg.*) ≡ *Aeonium caespitosum* (C. Smith ex Otto) Webb & Berthelot (1840); **incl.** *Sempervivum ciliare* Haworth (1821) (*nom. illeg.*); **incl.** *Sempervivum ligulare* Haworth (1821) (*nom. inval.*, Art. 34.1).

[2] Perennial caespitose **Ros** plants; stems stout, glabrous, smooth; **Ros** 4 - 12 cm Ø, cup-shaped; **L** 2 - 6 × 0.6 - 2 cm, 1.5 - 2 mm thick, lanceolate, apically acuminate, basally cuneate, puberulent, with conspicuous longitudinal brownish tannic stripes on lower face, margin with conical cilia (1 - 2.5 mm long), yellowish-green; **Inf** from basal **Ros Ax**, floriferous part 2 - 5 × 2 - 8 cm, densely leafy, 15- to 50-flowered; peduncle 5 - 30 cm long; **Ped** 1 - 9 mm, glabrous; **Fl** 7- to 9-merous; **Sep** glabrous; **Pet** 5 - 6 × 1.2 - 1.8 mm, oblanceolate, acute, yellow; **Fil** glabrous.

A. smithii (Sims) Webb & Berthelot (Phytogr. Canar. 3(2:1): 187, 1840). **T**: [lecto – icono]: Curtis's Bot. Mag. 45: t. 1980, 1818. – **D**: Canary Islands (Tenerife); 150 - 2150 m.

≡ *Sempervivum smithii* Sims (1818); **incl.** *Sempervivum hispicaule* Haworth (1819) (*nom. inval.*, Art. 34.1); **incl.** *Sempervivum foliosum* C. Smith ex Otto (1820) (*nom. inval.*).

[2] Perennial densely branched shrublets to 60 cm; **Br** 7 - 30 mm Ø, densely hairy (**Ha** 3 - 8 mm), smooth, without reticulations; **Ros** 6 - 15 cm Ø, rather flattish; **L** 3 - 7 × 1.3 - 3 cm, 1 - 1.5 mm thick, obtrullate, apically acuminate, basally cuneate, glossy above, puberulent, with conspicuous longitudinal brownish tannic stripes esp. on the lower face, margin with conical cilia (≤ 0.3 mm) and some additional **Ha** (0.1 - 0.5 mm); **Inf** floriferous part 4 - 15 × 4 - 9 cm; peduncle 4 - 40 cm; **Fl** 8- to 12-merous; **Ped** 1 - 9 mm, puberulent; **Sep** puberulent; **Pet** 7 - 9 × 2 - 2.5 mm, lanceolate, acute, yellow, with reddish lines; **Fil** glabrous.

A. spathulatum (Hornemann) Praeger (J. Bot. 66: 221, 1928). **T** [lecto]: Canary Islands (*Smith* s.n. [CJ]). – **D**: Canary Islands (Gran Canaria, Tenerife, Gomera, La Palma, Hierro); 250 - 2500 m. **Fig. III.f**

≡ *Sempervivum spathulatum* Hornemann (1819); **incl.** *Sempervivum lineolare* Haworth (1819); **incl.** *Sempervivum barbatum* C. Smith ex Otto (1820) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum villosum* Lindley (1832) (*nom. illeg.*, Art. 53.1); **incl.** *Aeonium cruentum* Webb & Berthelot (1840) ≡ *Sempervivum cruentum* (Webb & Berthelot) Webb ex Christ (1888) ≡ *Sempervivum spathulatum* var. *cruentum* (Webb & Berthelot) Praeger (1929) ≡ *Sempervivum strepsicladum* var. *cruentum* (Webb & Berthelot) Burchard (1929); **incl.** *Aeonium strepsicladum* Webb & Berthelot (1840) ≡ *Sempervivum strepsicladum* (Webb & Berthelot) Webb ex Christ (1888) ≡ *Aldasorea strepsiclada* (Webb & Berthelot) hort. ex Haage & Schmidt (1930); **incl.** *Aichryson pulchellum* C. A. Meyer (1842) ≡ *Sempervivum pulchellum* (C. A. Meyer) Walpers (1843); **incl.** *Aeonium bentejui* Webb ex Christ (1888) ≡ *Sempervivum bentejui* (Webb ex Christ) Christ (1888).

[2] Perennial densely branched shrublets to 60 cm; **Br** 1 - 3 cm Ø, puberulent, smooth, without reticulations; **Ros** 1 - 5 cm Ø, flattish to distinctly cup-shaped, inner **L** ± erect; **L** 0.5 - 2.5 × 0.3 - 0.9 cm, 1 - 1.5 mm thick, obovate-spatulate, apically obtuse, basally cuneate or attenuate, puberulent, lower face with conspicuous longitudinal brownish tannic stripes, margin with bead-shaped cilia (0.7 - 1 mm); **Inf** floriferous part lax, 3 - 10 × 3 - 15 cm; peduncle 5 - 20 cm; **Ped** 1 - 10 mm, puberulent; **Fl** 8- to 10-merous; **Sep** puberulent; **Pet** 4.5 - 6 × 1.5 - 2 mm, elliptic, obtuse, yellow, often with reddish lines; **Fil** glabrous.

A. stuessyi H.-Y. Liu (Syst. Aeonium, 77-78, ill., 1989). **T**: Tanzania (*Vesey-FitzGerald* 6398 [EA, KJ]). – **D**: E Africa (Ethiopia, Kenya, Tanzania); 2000 - 3000 m.

[1] Perennial few-branched subshrubs to 2 m; **Br** ascending to decumbent, often in groups, 1 - 2 cm Ø, glabrous, smooth; **Ros** 10 - 20 cm Ø, centre flattened with young **L** tightly appressed to each other; **L** 5 - 12 × 2.5 - 3.5 cm, 3 - 5 mm thick, oblanceolate- to obovate-spatulate, apically acute or acuminate, basally cuneate, puberulent, margin with straight or curved cilia (0.4 - 1.0 mm), yellowish-green to dark green, usually reddish variegated along margin; **Inf** 8 - 18 × 8 - 18 cm; peduncle 3 - 15 cm; **Fl** 7- to 11-merous; **Ped** 1 - 6 mm, sparsely puberulent; **Sep** sparsely puberulent; **Pet** 7 - 8 × 1.5 - 2.5 mm, obovate or elliptic, retuse, yellow, with reddish lines; **Fil** glabrous.

A. tabuliforme (Haworth) Webb & Berthelot (Phytogr. Canar. 3(2:1): 185, 1840). **T** [neo]: Canary Islands, Tenerife (*Liu* 3153 [OS]). – **D**: Canary Islands (N Tenerife); to 850 m.

≡ *Sempervivum tabuliforme* Haworth (1819); **incl.** *Aeonium tabulaeforme* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Sempervivum complanatum* A. De Candolle (1851); **incl.** *Aeonium berthelotianum* Bolle (1859) ≡ *Sempervivum berthelotianum* (Bolle) Christ (1888); **incl.** *Aeonium macrolepum* Webb ex Christ (1888) ≡ *Sempervivum macrolepum* (Webb ex Christ) Christ (1888).

[5] Biennial to perennial, solitary or very rarely caespitose, monocarpic **Ros**; stems stout, smooth, short to almost absent; **Ros** 9 - 40 cm Ø, flat with all **L** imbricate and tightly appressed to each other; **L** 4 - 20 × 2 - 4 cm, 3 - 6 mm thick, obovate to oblanceolate, apically rounded, mucronate, basally cuneate, glabrate (puberulent when young), margin fimbriate (**Ha** 0.5 - 2 mm), pale to bright green; **Inf** 15 - 30 × 12 - 30 cm; peduncle 12 - 30 cm; **Ped** 2 - 20 mm; **Fl** 7- to 9-merous; **Sep** pubescent; **Pet** 6 - 7 × 1.5 - 2 mm, elliptic, acute, pale yellow; **Fil** glabrous.

A. undulatum Webb & Berthelot (Phytogr. Canar. 1: 197, 1841). **T**: Canary Islands (*Anonymus* s.n. [not located]). – **D**: Canary Islands (Gran Canaria); 300 - 1500 m.

≡ *Sempervivum undulatum* (Webb & Berthelot) Webb ex Christ (1888); **incl.** *Aeonium yongianum* Webb & Berthelot (1841) ≡ *Sempervivum yongianum* (Webb & Berthelot) Webb ex Christ (1888).

[1] Perennial unbranched or basally few-branched, often monocarpic subshrubs to 2.5 m; **Br** ± erect, 1 - 3 cm Ø, glabrous, smooth; **Ros** 10 - 30 cm Ø, centre flattened; **L** 6 - 18 × 3 - 5 cm, 1.5 - 3 mm thick, oblanceolate-spatulate or oblong-spatulate, apically acute, mucronate, basally cuneate, glabrate, margin with curved cilia (0.5 - 2 mm), dark green, often reddish variegated along margin and near apex; **Inf** 12 - 50 × 12 - 40 cm; peduncle 5 - 20 cm; **Fl** 9- to 12-merous; **Ped** 1 - 8 mm, glabrous; **Sep** glabrous; **Pet** 6 - 8 × 1.2 - 1.5 mm, lanceolate, retuse, yellow; **Fil** glabrous.

A. urbicum (C. Smith ex Hornemann) Webb & Berthelot (Phytogr. Canar. 3(2:1): 194, 1841). **T**: Canary Islands, Tenerife (*Smith* s.n. [C?, BM]). – **D**: Canary Islands (Tenerife); to 1900 m.

≡ *Sempervivum urbicum* C. Smith ex Hornemann (1819); **incl.** *Aeonium pseudurbicum* Bañares (1992); **incl.** *Aeonium urbicum* var. *meridionale* Bañares (1999).

[4] Perennial monocarpic unbranched or rarely few-branched subshrubs to 2 m; **Br** ascending, to 6 cm Ø, glabrous but rough when young, reticulate; **Ros** 15 - 32 cm Ø, rather flattish; **L** 8 - 22 × 3 - 5.5 cm, 4 - 7 mm thick, obovate-spatulate or oblanceolate, apically acuminate, basally cuneate, glaucous or green, glabrate or puberulent, margin with ± straight cilia (0.5 - 1 mm), yellowish-green to dark green, variously reddish variegated; **Inf** dome-shaped, 15 - 75 × 10 - 45 cm; peduncle 3 - 15 cm; **Fl** 8- to 10-merous; **Ped** 2 - 6 mm, glabrous; **Sep** glabrous; **Pet** 7 - 10 × 1.2 - 2 mm, lanceolate, acuminate, whitish, occasionally reddish variegated; **Fil** glabrous.

Plants from Gomera formerly identified as *A. urbicum* have recently been described as *A. appendiculatum*.

A. valverdense (Praeger) Praeger (J. Bot. 66: 222, 1928). **T** [lecto]: Canary Islands, Hierro (*Praeger* s.n. [K]). – **D**: Canary Islands (Hierro); to 800 m.

≡ *Sempervivum valverdense* Praeger (1925).

[4] Perennial few-branched subshrubs to 1 m; **Br** ascending, usually in groups, 10 - 20 mm Ø, glabrous, reticulate; **Ros** 12 - 25 cm Ø, rather flat, inner **L** ascending; **L** 6 - 12 × 4 - 6 cm, 5 - 8 mm thick, obovate, apically acute, occasionally mucronate, basally cuneate, puberulent, margin with ± straight or slightly curved cilia (0.8 - 1.2 mm), green to yellowish-green, often pinkish variegated; **Inf** dome-shaped, 10 - 30 × 10 - 25 cm; peduncle 5 - 30 cm; **Ped** 2 - 4 mm, puberulent; **Fl** 7- to 9-merous; **Sep** puberulent; **Pet** 10 - 12 × 2 - 2.5 mm, lanceolate, acuminate, whitish, often pinkish or reddish variegated; **Fil** puberulent.

AFROVIVELLA

H. 't Hart

Afrovivella A. Berger (NPF2, 18a: 466-467, 1930). **T**: *Umbilicus semiensis* Gay ex A. Richard [Typification by inference, only element included.]. – **Lit**: Egli (1988: 84-85, ills.); Gilbert (1989: 15-16, ills.); both as *Rosularia* **D**: Ethiopia. **Etym**: From Lat. 'Africa', Africa, for its occurrence; and in allusion to the similarly rosette-producing genus *Sempervivella* (Crassulaceae).

Perennial herbs; **Ros** sessile, with a narrow taproot, ± flat, 1.5 - 4 cm Ø, offsetting with brown brittle runners to 8 cm and forming crowded mats; **L** loosely arranged, spatulate with ± triangular apex

terminating in short or long mucro, 1 - 2 cm, pale green, glabrous or shortly glandular-hairy, margin with long whitish stiff or flexible setae; **Inf** lateral reduced thyrses, 1- to 5-flowered, 1 - 5 cm, brownish glandular-hairy; **Fl** 5- to 7-merous, 1.2 - 1.8 cm, campanulate, outside glandular; **Pet** united for $\frac{1}{3}$, white, outside tinged reddish, apex mucronate; **NSc** oblong, acicular; **Ca** slender.

A monotypic genus, previously placed in the synonymy of *Rosularia*.

A. semiensis (J. Gay ex A. Richard) A. Berger (NPF2 18a: 467, 1930). **T:** Ethiopia, Semien Prov. (*Schimper* 1337 [P?, BERN, BM, G, K, L, LE, NEU, STU, W]). – **D:** Ethiopia (Semien Mts.); 3500 - 3700 m. **I:** Egli (1988: 85, as *Rosularia*). **Fig. III.g**

≡ *Umbilicus semiensis* J. Gay ex A. Richard (1847) ≡ *Rosularia semiensis* (J. Gay ex A. Richard) H. Ohba (1978); **incl.** *Sempervivum simense* Hochstetter ex A. Richard (1847) (*nom. inval.*, Art. 34.1c); **incl.** *Cotyledon simensis* Britten (1871).

Description as for the genus.

The species does not appear to be in cultivation.

AICHRYSON

R. Nyffeler

Aichryson Webb & Berthelot (Phytogr. Canar. 1: 180, 1840). **T:** *Sempervivum dichotomum* De Candolle [Typification according to D. Bramwell, Bol. Inst. Nac. Invest. Agron. 28: 204, 1968 (= *Aichryson dichotomum*, treated as synonym of *A. laxum* (Haworth) Bramwell)]. – **Lit:** Praeger (1932); Bramwell (1968); Bramwell (1977); Bramwell & Bramwell (1990); Press & Short (1994); Bañares Baudet (1997). **D:** Canary Islands, Madeira, Azores (Santa Maria); naturalized in Portugal. **Etym:** Gr. 'aei', always; and Gr. 'chrysos', gold; referring to the flower colour.

Incl. *Macrobia* (Webb & Berthelot) G. Kunkel (1977). **T:** *Sempervivum tortuosum* Aiton.

Annual to triennial, single or sparsely to densely branched, monocarpic herbs or small, tortuously branched perennial shrublets, glabrous, glabrate or densely hairy (**Ha** partly **Gl**-tipped), often strongly tinged purplish-red; **R** fibrous; stems 3 - 12 mm Ø at the base, densely hairy or glabrous; **Br** occasionally slightly woody, ascending or spreading, branching dichotomously or divaricately; **L** simple, alternate, often slightly rosulate near the **Br**-tips, sessile or distinctly petiolate, ± distinctly succulent, ovate, obovate, trullate, rhombic or obtrullate, blunt, rounded or somewhat acute, cuneate, attenuate or truncate, entire or slightly crenulate, glabrous, glabrescent or distinctly hairy, rarely glandular-hairy and viscid, often tinged purplish-red; **Inf** at the **Br**-tips, either few- or many-branched or from few-leaved shoots, lax, occasionally somewhat

corymboid; **Ped** filiform, 2 - 20 mm; **Fl** 6- to 12-merous, 6 - 16 mm Ø; **Sep** fleshy, basally connate, glabrous or hairy; **Pet** lanceolate, elliptic or ovate, acuminate, occasionally apiculate, pale or deep yellow; **St** 2× as many as **Pet**; **Fil** free, filiform; **Anth** cylindrical, yellowish; **NSc** 0.5 - 0.9 × 0.4 - 0.6 mm, oblong, 2- to 5-fid, cuneate; **Ca** as many as **Pet**, basally immersed in the **Rec**, yellowish, glabrous or with some glandular **Ha**; **Se** distinctly papillate to costate, brownish.

The genus is urgently in need of a thorough revision. The present treatment follows the synopsis by Bramwell (1968). A survey of herbarium specimens revealed that many characters generally used to distinguish the various species (e.g. leaf shape, leaf margin, indumentum) are unreliable. The short-living taxa of this genus are very plastic. When starved they may look very different from well-grown specimens.

The following natural hybrids have been recorded: *A. ×bramwellii* G. Kunkel 1972 = *A. porphyrogennetos* × *A. punctatum* (Gran Canaria); *A. ×intermedium* Bramwell & G. D. Rowley 1973 = *A. laxum* × *A. punctatum* (Tenerife, Hierro, La Palma); *A. ×praegeri* G. Kunkel 1972 = *A. laxum* × *A. porphyrogennetos* (Gran Canaria).

A. ×aizoides and *A. tortuosum* (much more rarely *A. bethencourtianum*) are most frequently found in cultivation. *A. laxum* is the only monocarpic taxon of some horticultural interest.

The genus is here divided according to the following synoptical classification:

- [1] Sect. *Aichryson* (incl. *Aichryson* Sect. *Hapaxantha* Webb & Berthelot): Annuals to triennials:
 - [1.1] **L** blade densely hairy:
 - [1.1a] **L** blade broadest below middle; upper **Br** dichotomously ascending.
 - [1.1b] **L** blade broadest at or above middle; plants unbranched or **Br** spreading.
 - [1.2] **L** blade glabrous or glabrate.
- [2] Sect. *Macrobia* Webb & Berthelot 1840: Perennials forming small shrublets.

The nothogenus *×Aeonichryson* was published for a purported hybrid between *Aeonium* and *Aichryson*, but there is no evidence that such hybrids do exist.

The following names are of unresolved application but are referred to this genus: *Petrophytes purpurascens* Bolle & Webb (1859) ≡ *Monanthes purpurascens* (Bolle & Webb) Christ (1888).

A. ×aizoides (Lamarck) E. C. Nelson (Bradleya 11: 94, 1994). – **D:** Garden origin.

≡ *Sempervivum aizoides* Lamarck (1789) ≡ *Aeonium aizoides* (Lamarck) A. Berger (1930) ≡ *Aichryson ×domesticum* var. *aizoides* (Lamarck) Praeger (1932) ≡ *×Aeonichryson aizoides* (Lamarck) P. V. Heath (1992); **incl.** *Aichryson ×aizoides* var. *aizoides*; **incl.** *Aichryson ×aizoides* var. *domesticum*

'*Variegatum*' (s.a.); **incl.** *Aichryson* $\times$ *domesticum* 'Variegatum' (s.a.); **incl.** *Sempervivum tortuosum* De Candolle (s.a.) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum domesticum* Praeger (1927) $\equiv$ *Aichryson* $\times$ *domesticum* (Praeger) Praeger (1927) (*incorrect name*, Art. 11.3) $\equiv$ *Aeonium domesticum* (Praeger) A. Berger (1930) $\equiv$ $\times$ *Aeonichryson aizoides* var. *domesticum* (Praeger) P. V. Heath (1992) $\equiv$ *Aichryson* $\times$ *aizoides* var. *domesticum* (Praeger) E. C. Nelson (1994); **incl.** *Aichryson* $\times$ *domesticum* fa. *foliis variegatis* Praeger (1932) (*nom. inval.*, Art. 23.1, 24.2); **incl.** *Sedum aizoides* De Candolle (s.a.).

Perennial densely branched sparsely hairy shrublets 20 - 30 cm tall; stems 4 - 7 mm $\varnothing$; **Br** slightly woody, divaricate; **L** 18 - 34 $\times$ 8 - 12 mm, fleshy, blade broadest above the middle, obovate or obtrullate, blunt or acuminate, gradually attenuate into an indistinct petiole, slightly glandular-hairy, viscid (scent resinous); **Inf** as sparsely leaved shoots 8 - 15 cm long, lax, $\pm$ few-flowered; **Ped** to 7 mm; **Fl** 7- to 8-merous, 12 - 14 mm $\varnothing$; **Sep** generally glandular-hairy; **Pet** 6 - 7 mm, oblanceolate, acuminate, reflexed, bright yellow.

This is most probably the hybrid *A. punctatum* (or *A. divaricatum*) $\times$ *A. tortuosum*. The cultivar 'Variegatum' (sometimes also referred to as "*A. $\times$ domesticum* fa. *foliis variegatis* Praeger") is most widely cultivated and is characterized by its leaves with whitish margins.

A. bethencourtianum Bolle (Bonplandia 7: 243, 1859). **T**: Canary Islands, Fuerteventura (*Bourgeau* 737 [FI [status?]]). – **D**: Canary Islands (Fuerteventura).

$\equiv$ *Aeonium bethencourtianum* (Webb ex Bolle) Bolle (1859) $\equiv$ *Sempervivum bethencourtianum* (Webb ex Bolle) Christ (1888) $\equiv$ *Macrobria bethencourtiana* (Webb ex Bolle) G. Kunkel (1977).

[2] Perennial densely branched downy shrublets to 15 cm tall; stems $\pm$ 5 mm $\varnothing$, hairy, often glabrous below; **Br** $\pm$ woody, tortuous, divaricate; **L** 12 - 18 $\times$ 6 - 10 mm, 2 - 3 mm thick, indistinctly petiolate, blade broadest above the middle, obovate, rounded, densely hairy, not viscid, often tinged purplish-red; **Inf** from leafy shoots 5 - 8 cm long, few-flowered; **Ped** to 5 mm; **Fl** 8- to 9-merous, 10 - 12 mm $\varnothing$; **Sep** hairy; **Pet** 5 - 6 mm, elliptic, acuminate, dorsally with some short **Ha** on the midvein, deep yellow.

A. bollei Webb ex Bolle (Bonplandia 7: 243-244, 1859). **T** [lecto]: Canary Islands, La Palma (*Bolle* 1298 [B]). – **D**: Canary Islands (La Palma); to 1600 m.

$\equiv$ *Sempervivum bollei* (Webb ex Bolle) Christ (1888).

[1.1a] Annual or biennial simple or sparsely branched pubescent herbs 25 - 35 cm tall; stem $\pm$ 4 mm $\varnothing$, with appressed **Ha** throughout, **Br** divaricate, ascending; **L** 25 - 35 $\times$ 10 - 22 mm, blade

broadest near the base, ovate or trullate, blunt, attenuate into a distinct petiole, densely hairy; **Inf** few-flowered; **Ped** to 4 mm; **Fl** 7- to 8-merous, 8 - 10 mm $\varnothing$; **Sep** hairy; **Pet** 4 - 5 mm, only slightly longer than the **Sep**, lanceolate, acute, pale yellow with a greenish stripe.

A taxon of doubtful status, probably closely related to *A. pachycaulon*.

A. brevipetalum Praeger (J. Bot. 66: 221, 1928). **T**: not extant. – **D**: Canary Islands (La Palma).

[1.1b] Annual simple or sparsely branched densely hairy herbs 5 - 8 cm tall; stems 2 - 3 mm $\varnothing$, hairy throughout; **Br** divaricate, ascending; **L** 12 - 18 $\times$ 5 - 7 mm, blade broadest at or above the middle, obovate, rounded, gradually narrowed into an indistinct petiole, often with 1 - 2 marginal dark spots on either side, hairy; **Inf** few-flowered; **Ped** 3 - 4 mm; **Fl** 6- to 7-merous, 7 - 8 mm $\varnothing$; **Sep** densely hairy; **Pet** 3 - 4 mm, generally shorter than the **Sep**, lanceolate, acuminate, apiculate, with purplish tip.

Very similar to *A. parlatorei* if not conspecific.

A. divaricatum (Aiton) Praeger (Acc. Sempervivum, 125, 1932). **T**: Madeira (*Masson* s.n. [BM]). – **D**: Madeira (Deserta Grande); (100-) 500 - 1000 m.

$\equiv$ *Sedum divaricatum* Aiton (1789) $\equiv$ *Anacampseros divaricata* (Aiton) Haworth (1812) $\equiv$ *Sempervivum divaricatum* (Aiton) Lowe (1864); **incl.** *Sempervivum divaricatum* var. *politum* Lowe (1864); **incl.** *Sempervivum divaricatum* var. *pubescens* Lowe (1864).

[1.2] Annual or biennial rather few-branched glabrous herbs 10 - 30 cm tall; stems 3 - 6 mm $\varnothing$; lower **Br** dichotomous, ascending; **L** 10 - 30 $\times$ 8 - 24 mm, blade broadest near the base, widely ovate or trullate, blunt or rounded, truncate to abruptly narrowed into a distinct petiole (about as long as the blade), glabrous; **Inf** $\pm$ corymboid, many-flowered; **Ped** 2 - 9 mm; **Fl** 6- to 7-merous, 6 - 10 mm $\varnothing$; **Sep** glabrous or slightly hairy; **Pet** 3 - 5 mm, ovate, acuminate, pale yellow with greenish midrib.

A. dumosum (Lowe) Praeger (Acc. Sempervivum, 127, 1932). **T**: Madeira (*Lowe* s.n. [K]). – **D**: SW Madeira; 300 - 400 m.

$\equiv$ *Sempervivum dumosum* Lowe (1864).

[1.2] Annual or biennial rather few-branched glabrous to sparsely hairy herbs 15 - 30 cm tall; stems 4 - 7 mm $\varnothing$, glabrous; lower **Br** dichotomous, ascending; **L** 12 - 18 $\times$ 3 - 5 mm, indistinctly stalked, blade broadest above middle, oblanceolate, blunt, basally attenuate, minutely pubescent, often tinged purplish-red; **Inf** $\pm$ corymboid, many-flowered; **Ped** to 9 mm; **Fl** 6- to 7-merous, 8 - 10 mm $\varnothing$; **Sep** almost glabrous; **Pet** 4 - 5 mm, ovate, acute, bright yellow with reddish midrib.

A. laxum (Haworth) Bramwell (Bol. Inst. Nac. In-

vest. Agron. 28(59): 207, 1968). – **D**: Canary Islands (except Lanzarote and possibly Fuerteventura); naturalized in Portugal (Serra de Sintra); 400 - 1200 m. **Fig. IV.a**

≡ *Sempervivum laxum* Haworth (1821) ≡ *Aeonium laxum* (Haworth) Webb & Berthelot (1840); **incl.** *Sempervivum annuum* C. Smith ex Buch (1819) (*nom. inval.*, Art. 32.1); **incl.** *Sempervivum dichotomum* De Candolle (1826) ≡ *Aichryson dichotomum* (De Candolle) Webb & Berthelot (1840) ≡ *Sedum dichotomum* (De Candolle) Hamet (1929); **incl.** *Sempervivum molle* Visiani (1841); **incl.** *Sempervivum divaricatum* fa. *maximum* Kuntze (1891); **incl.** *Aichryson dichotomum* fa. *foliis purpureis* Praeger (1932) (*nom. inval.*, Art. 23.1, 24.2); **incl.** *Aichryson laxum* fa. *subglabrum* G. Kunkel (1977).

[1.1a] Annual or most often biennial densely or sparsely hairy (**Ha** to 4 mm) herbs 20 - 40 (- 80) cm tall; stems 7 - 12 mm Ø, generally hairy throughout, lower **Br** slightly woody, dichotomous, ascending; **L** 25 - 60 × 15 - 30 mm, blade broadest near the base, widely ovate or trullate, blunt or rounded, truncate to abruptly narrowed into a distinct petiole, densely hairy, often tinged purplish-red; **Inf** lax, many-flowered; **Ped** 6 - 12 mm; **Fl** 9- to 12-merous, 13 - 16 mm Ø; **Sep** hairy; **Pet** 6 - 8 mm, lanceolate, acuminate, deep yellow.

This species is often encountered under the name of *A. dichotomum* (e.g. Flora Europaea). *A. laxum* has priority, however, but its application is questioned by some authors.

A. pachycaulon Bolle (Bonplandia 7: 244, 1859). **T** [lecto]: Canary Islands (Bolle 1394 [B]). – **D**: Canary Islands (Fuerteventura, Gran Canaria, Tenerife, Gomera, La Palma); 600 - 1000 m. **Fig. IV.c**

≡ *Sempervivum pachycaulon* (Bolle) Christ (1888) ≡ *Aichryson punctatum* var. *pachycaulon* (Bolle) Praeger (1928); **incl.** *Aichryson parviflorum* Bolle (1859) ≡ *Aichryson pachycaulon* ssp. *parviflorum* (Bolle) Bramwell (1977); **incl.** *Aichryson immaculatum* Webb ex Christ (1888) ≡ *Sempervivum immaculatum* (Webb ex Christ) Christ (1888) ≡ *Aichryson pachycaulon* ssp. *immaculatum* (Webb ex Christ) Bramwell (1977); **incl.** *Aichryson gonzalez-hernandezii* G. Kunkel (1975) ≡ *Aichryson pachycaulon* ssp. *gonzalez-hernandezii* (Kunkel) Bramwell (1977); **incl.** *Aichryson pachycaulon* ssp. *praetermissum* Bramwell (1977).

[1.2] Biennial to triennial glabrous or glabrescent herbs 20 - 35 cm tall; stems ± 10 mm Ø, naked, lower **Br** divaricate, ascending; **L** 25 - 65 × 20 - 35 mm, suberect, densely clothing the **Br**, blade broadest at or above the middle, rhombic or obtrullate, blunt, narrowed into an indistinct petiole, glabrous or almost so; **Inf** dense, many-flowered; **Ped** to 6 mm; **Fl** 8- to 9-merous, 9 - 11 mm Ø; **Sep** glabrescent; **Pet** 5 - 6 mm, lanceolate, acuminate, apiculate, golden-yellow.

Similar to *A. punctatum* but generally without purplish crenulations.

A. palmense Webb ex Bolle (Bonplandia 7: 243, 1859). **T**: Canary Islands, La Palma (*Bourgeau* 729 [not located]). – **D**: Canary Islands (La Palma); 300 - 800 m.

≡ *Sempervivum palmense* (Webb ex Bolle) Christ (1888).

[1.1a] Biennial to triennial glandular-hairy herbs to 20 cm tall; stems ± 6 mm Ø, distinctly hairy throughout, lower **Br** divaricate, spreading; **L** 25 - 45 × 20 - 30 mm, blade broadest near the base, widely ovate, acute or rounded, attenuate into a distinct petiole (to 2 cm), densely glandular-hairy, viscid; **Inf** lax, few-flowered; **Ped** 8 - 20 mm; **Fl** 8- to 9-merous, 12 - 14 mm Ø; **Sep** glandular-hairy; **Pet** 6 - 7 mm, lanceolate, acuminate, pale yellow.

A. parlatoarei Bolle (Bonplandia 7: 244, 1859). **T** [lecto]: Canary Islands, Gomera (Bolle 1302 [B]). – **D**: Canary Islands (Gran Canaria, Tenerife, Gomera, La Palma, Hierro); 30 - 1000 m. **Fig. IV.b**

≡ *Sempervivum parlatoarei* (Bolle) Christ (1888) ≡ *Aichryson punctatum* fa. *parlatoarei* (Bolle) Praeger (1932); **incl.** *Sempervivum subvillosum* Lowe (1864) ≡ *Sempervivum divaricatum* var. *subvillosum* (Lowe) Kuntze (1891) ≡ *Sempervivum villosum* var. *subvillosum* (Lowe) Bornmüller (1903) ≡ *Aichryson punctatum* var. *subvillosum* (Lowe) Pitard & Proust (1909); **incl.** *Aichryson punctatum* var. *villosum* Webb ex Christ (1888) ≡ *Sempervivum punctatum* var. *villosum* (Webb ex Christ) Christ (1888); **incl.** *Aichryson subvillosum* Praeger (1928); **incl.** *Aichryson molle* Webb ex Stapf (1933) (*nom. inval.*, Art. 29.1).

[1.1b] Annual simple or sparsely branched densely hairy herbs to 12 cm tall; stems 2 - 3 mm Ø, mostly hairy in the lower part, lower **Br** divaricate, spreading; **L** 12 - 24 × 6 - 8 mm, blade broadest above the middle, obtrullate, blunt or acute, gradually narrowed into a broad indistinct petiole, often papillose along the margins, densely hairy; **Inf** lax, few-flowered; **Ped** 7 - 10 mm; **Fl** 8- to 9-merous, 10 - 12 mm Ø; **Sep** densely hairy; **Pet** 5 - 6 mm, elliptic or obovate, acuminate, deep yellow.

Very similar to *A. villosum* from Madeira.

A. porphyrogennetos Bolle (Bonplandia 7: 243, 1859). **T** [lecto]: Canary Islands, Gran Canaria (Bolle 1303 [B]). – **D**: Canary Islands (Gran Canaria); 600 - 1000 m.

≡ *Sempervivum porphyrogennetos* (Bolle) Christ (1888).

[1.1b] Biennial to triennial densely hairy herbs often tinged purplish, 15 - 45 cm tall; stems 6 - 10 mm Ø, mostly hairy in the lower part, lower **Br** slightly woody, divaricate, spreading; **L** 25 - 50 × 15 - 35 mm, blade broadest at or above the middle, obtrullate, acute or rounded, gradually narrowed

into a distinct petiole (to 2 cm), densely hairy, tinged purplish-red; **Inf** lax, $\pm$ many-flowered; **Ped** 6 - 10 mm; **Fl** 7- to 10-merous, 10 - 13 mm $\varnothing$; **Sep** hairy; **Pet** 5 - 7 mm, broadly oblanceolate, cuspidate, golden-yellow.

Very similar to *A. laxum* but separated on the base of its divaricate-spreading branching.

A. punctatum (C. Smith *ex* Link) Webb & Berthelot (Phytogr. Canar. 1: 182, 1840). – **D:** Canary Islands (except Lanzarote and possibly Fuerteventura); 100 - 1200 m.

$\equiv$ *Sempervivum punctatum* C. Smith *ex* Link (1828) $\equiv$ *Sempervivum divaricatum* var. *punctatum* (C. Smith *ex* Link) Kuntze (1891) $\equiv$ *Sempervivum villosum* var. *punctatum* (C. Smith *ex* Link) Bornmüller (1903); **incl.** *Aichryson pinnatum* Knoche (1923) (*nom. inval.*, Art. 61.1) $\equiv$ *Sempervivum pinnatum* (Knoche) Lindinger (1926) (*nom. inval.*, Art. 61.1).

[1.2] Annual to triennial glabrous or glabrescent herbs 20 - 60 cm tall; stems 5 - 12 mm $\varnothing$, glabrous below, **Br** divaricate, ascending; **L** 20 - 40 $\times$ 12 - 25 mm, blade broadest below the middle, widely trullate or ovate, blunt, narrowed into a distinct petiole, slightly crenulate, with some purplish spots along the margins, glabrous or slightly glabrescent; **Inf** $\pm$ corymboid, generally many-flowered; **Ped** 3 - 6 mm; **Fl** 7- to 9-merous, 10 - 12 mm $\varnothing$; **Sep** slightly hairy; **Pet** 6 - 7 mm, lanceolate or ovate, acuminate, apiculate, deep yellow.

A. tortuosum (Aiton) Webb & Berthelot (Phytogr. Canar. 1: 184, *quoad basionym.*, 1840). **T:** BM. – **D:** Canary Islands (Lanzarote, Fuerteventura); to 700 m.

$\equiv$ *Sempervivum tortuosum* Aiton (1789) $\equiv$ *Aeonium tortuosum* (Aiton) A. Berger (1930) $\equiv$ *Macrobria tortuosa* (Aiton) G. Kunkel (1977); **incl.** *Sempervivum villosum* Haworth (1812) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum pygmaeum* C. Smith *ex* Link (1828) $\equiv$ *Aichryson pygmaeum* (C. Smith *ex* Link) Webb & Berthelot (1840); **incl.** *Aichryson radicans* Webb & Berthelot (1840) $\equiv$ *Sempervivum radicans* (Webb & Berthelot) Christ (1888); **incl.** *Aichryson pulvinatum* Burchard (1913) $\equiv$ *Sempervivum pulvinatum* (Burchard) Praeger (1925).

[2] Perennial densely branched downy shrublets to 15 cm tall; stems $\pm$ 5 mm $\varnothing$, hairy, often glabrous below, **Br** woody, tortuous, divaricate; **L** 10 - 12 $\times$ 4 - 6 mm, 2 - 3 mm thick, blade broadest above the middle, obovate, rounded, sessile, densely glandular-hairy, viscid (scent resinous), tinged purplish-red; **Inf** from short laxly leafy shoots, few-flowered; **Ped** to 7 mm; **Fl** 7- to 8-merous, 9 - 12 mm $\varnothing$; **Sep** glandular hairy; **Pet** 5 - 6 mm, elliptic, acuminate, aristate, deep yellow, tips reflexed, margins often finely ciliate.

A. villosum (Aiton) Webb & Berthelot (Phytogr.

Canar. 1: 181, 1840). **T:** Madeira (*Masson* s.n. [BM]). – **D:** Azores (Santa Maria), Madeira, Desertas, Porto Santo; to 1300 m.

$\equiv$ *Sempervivum villosum* Aiton (1789) $\equiv$ *Sempervivum divaricatum* var. *villosum* (Aiton) Kuntze (1891); **incl.** *Sempervivum stellatum* J. E. Smith (1791); **incl.** *Sempervivum barrettii* C. A. Menezes (1922).

[1.1a] Annual simple or sparsely branched densely hairy herbs 8 - 18 cm tall; stems to 4 mm $\varnothing$, densely hairy, occasionally glabrous below, lower **Br** divaricate, spreading; **L** 12 - 24 $\times$ 8 - 18 mm, blade broadest near the base, widely obtusulate, blunt or rounded, rather abruptly attenuate into a distinct petiole ($\pm$ as long as the blade), densely hairy (**Ha** to 2 mm), often tinged purplish-red; **Inf** lax, few-flowered; **Ped** 5 - 15 mm; **Fl** 7- to 8-merous, 12 - 15 mm $\varnothing$; **Sep** densely hairy; **Pet** 5 - 7 mm, lanceolate, acute, deep yellow.

COTYLEDON

E. van Jaarsveld

Cotyledon Linné (Spec. Pl. [ed. 1], 429, 1753). **T:** *Cotyledon orbiculata* Linné [Lectotype, and proposed for conservation by Tölken in Jarvis, Taxon 41: 561, 1992]. – **Lit:** Tölken (1985: 3-17). **D:** S and E tropical Africa, SW Arabian Peninsula. **Etym:** Lat., "Pennywort" (*Umbilicus rupestris*), from Gr. 'kotyledon', cup, hollowed; because Pennywort was part of the genus originally.

Incl. *Cotylaria* Rafinesque (*nom. illeg.*, Art. 52.1). **T:** *Cotyledon orbiculata* Linné.

Perennial evergreen procumbent to decumbent low-growing to erect shrubs to 3 m high, rarely climbers; **R** fibrous; **Br** succulent, terete to torulose from thickened **L**-bases, often becoming woody with peeling bark; **L** decussate, flat or terete, rarely lobed or orbicular, rarely concave or channelled on upper side; lamina glabrous, hairy or glandular hairy; **Inf** low to raised terminal thyrses of several dichasia ending in monochasia, each with 1 to many pendent obdiplostemonous **Fl**; **Sep** 5, green, triangular to triangular-lanceolate; **Cl** tubular, rarely ventricose at base, hairy or glabrous, lobes free and spreading, often becoming recurved or reflexed; **St** 10 in 2 series, fused to the **Cl** at the base with tufts of **Ha** where fused, exerted for $\pm$ $\frac{1}{3}$ of their length; **Anth** compressed to globose, curving outwards; **Ca** 5, free, tapering into erect **Sty**; **NSc** small, oblong to transversely oblong, often cup-shaped; **Sti** capitate, curved outwards; **Fr** erect follicles; **Se** ellipsoid, very small.

Today, *Cotyledon* is a small genus with 10 species with the greatest concentration in the former Cape Province (RSA). Earlier, however, *Cotyledon* served as a 'hold-all' genus for *Crassulaceae* with fused petals, embracing many groups that have se-

parate generic status today (e.g. *Echeveria*, *Rosularia* etc.).

Cotyledon species are frequently cultivated for their ornamental value, and some are used medicinally for the treatment of warts and abscesses. Pollination is by sunbirds. *C. orbiculata* is the most variable and frequently cultivated species. Plants are easily propagated from stem cuttings or seed.

C. adscendens R. A. Dyer (FPA 27: t. 1080 + text, 1949). **T:** RSA, Eastern Cape (*Erens* s.n. [PRE 28367, BOL]). – **D:** RSA (Eastern Cape); dune thickets, summer-flowering.

Scandent, sparingly branched, to 1.6 m with erect to spreading **Br**; **L** green, obovate to spatulate, 2 - 6 × 1 - 2.8 cm, flat, slightly concave, margin reddish in the upper ½, base cuneate, apex acute, mucronate; **Inf** 15 - 36 cm with 1 - 3 dichasia; peduncle purplish, 3 mm Ø at the base; **Ped** 13 - 22 mm; **Sep** 5 × 4 mm; **Cl** tubular, orange-red, 15 - 24 mm, tube 12 - 18 × 10 mm Ø, lobes loriate, 13 × 5 mm wide at the base; **St** 22 mm, fused to the **Cl** tube for 7 mm; **Anth** 1.5 mm; **Ca** (incl. **Sty** and **Sti**) 20 mm; **NSc** transversely oblong, 1 × 2.5 mm, ascending-spreading, thickish, yellow.

C. barbeyi Schweinfurth *ex* Baker (Gard. Chron., ser. 3, 13: 624, 1893). **T:** Ethiopia (*Schweinfurth* 1493 [K]). – **D:** S and E tropical Africa, SW Arabian Peninsula; rocky outcrops in savanna. **I:** Tölken (1985: 4).

Incl. *Cotyledon wickensii* Schönland (1915); **incl.** *Cotyledon transvaalensis* Guillaumin (1936); **incl.** *Cotyledon wickensii* var. *glandulosa* von Poellnitz (1937); **incl.** *Cotyledon sturmiana* von Poellnitz (1939).

Erect branched shrubs 0.5 - 2 m, **Br** ascending, to 25 mm Ø at the base, with yellow-grey peeling bark; **L** very variable in shape and vestiture, 4 - 28 × 1 - 4.5 cm, oblanceolate to linear, upper face flat to grooved, surface glabrous, pubescent or sometimes glandular-pubescent, base cuneate, apex mucronate, petiole short, decurrent on the stem or absent; **Inf** erect, 20 - 60 cm with 3 - 5 dichasia; peduncle with 1 to 2 pairs of **Bra** 22 × 5 mm; **Sep** green, 6 × 4 mm; **Cl** tubular, orange to red, 20 - 25 mm, tube 14 - 18 mm, base inflated with 5 bulges, each 5 mm long (between the **Sep**); **Cl** lobes 15 mm, recurved; **St** 27 - 36 mm, exserted for 5 - 14 mm; **Anth** yellow, globose; **Ca** 28 mm; **NSc** spreading, oblong, yellow-green, 4 - 5 × 1.5 mm.

A very variable taxon, of which several cultivars are recognized:

‘Blouberg’: **L** glabrous, obovate, to 8 × 4.5 cm, margin with few large undulations. Originally from the Blouberg, Northern Cape, RSA.

‘Dikblaar’: Large robust plant with heavy large grey-hairy **L** 12 × 4.5 cm.

‘Golfrand’: **L** elliptic, glabrous, 12.5 × 5 cm, margin in the upper ⅓ with small undulations.

‘Langblaar’: **L** long, glabrous, linear-lanceolate, curved, shiny-green, channelled, to 25.5 × 1.5 cm; **Inf** compact, 12 - 13 cm long. Originally from the Strijdom Tunnel, Mpumalanga, RSA.

‘Steelpoort’: **L** hairy, oblong-obovate, green, 11.5 × 4.5 cm, upper part of the margin slightly undulate. Originally from Steelpoort, Mpumalanga, RSA.

C. campanulata Marloth (Trans. South Afr. Philos. Soc. 18: 46, t. 5: fig. 6, 1907). **T:** RSA, Eastern Cape (*Marloth* 4379 [PRE]). – **D:** RSA (Eastern Cape); Noorsveld and Valley Bushveld, summer-flowering.

Incl. *Cotyledon teretifolia* Thunberg (1794) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon teretifolia* var. *subglabra* Harvey (1862) (*nom. inval.*, Art. 43.1).

Decumbent to erect, to 20 cm tall; **Br** erect to erectly spreading; **L** hairy, shortly petiolate, occasionally viscid due to glandular **Ha**, lamina 4 - 13 × 1 - 3.5 cm, linear (sometimes almost terete), rarely lanceolate, upper face grooved, green to yellowish-green, base cuneate, apex often heart-shaped with undulating reddish-brown margin, cuspidate; **Inf** erect, viscid, 15 - 30 cm with 3 - 5 dichasia; peduncle 6 mm Ø at base; **Ped** to 20 mm; **Sep** triangular, 4 mm; **Cl** yellow, tube cylindrical to urceolate, 5 - 8 × 10 - 11 mm Ø, lobes 17 - 18 mm, triangular-lanceolate, spreading; **St** exserted for up to 10 mm; **Anth** 1.5 mm Ø, flattened; **NSc** transversely oblong, to 1 × 2 mm, yellowish.

The following cultivars are recognized:

‘Nieuw-Bethesda’: **L** ovate-lanceolate, to 3 × 1.2 cm, channelled with a spatulate tip, apex acute, reddish, mucronate. Originally from Nieuw-Bethesda in the Eastern Cape.

‘Vingers’: Spreading round shrublets to 14 cm; **L** linear-elliptic, 7 × 1.7 cm, with short **Ha**, margin green, undulating near the tip and reddish.

C. cuneata Thunberg (Prodr. Fl. Cap., 83, 1794). **T:** RSA, Cape Prov. (*Thunberg* s.n. [UPS [Herb. Thunberg 11001]]). – **D:** RSA (Northern Cape, Western Cape); Succulent and Nama Karoo.

≡ *Adromischus cuneatus* (Thunberg) Lemaire (1852); **incl.** *Cotyledon pillansii* Schönland (1907).

Decumbent to erect short shrubs, to 30 cm (excl. **Inf**); **Br** decumbent to ascending; **L** variable, glaucous to glabrous, rarely viscid, lamina 6 - 17 × 2.5 - 10 cm, obovate to oblanceolate, margin reddish, base cuneate, shortly petiolate, apex cuspidate; **Inf** erect, viscid, 20 - 80 cm with 3 - 5 dichasia; peduncle 12 mm Ø at base; **Ped** to 12 × 2 mm Ø; **Sep** 5 mm; **Cl** yellow, viscid, tube cylindrical to urceolate, 6 - 10 × 10 - 11 mm Ø; **Cl** lobes spreading, to 18 mm; **St** exserted for 10 - 12 mm; **NSc** transversely oblong 1.5 × 2 mm, yellowish.

C. eliseae van Jaarsveld (*Bradleya* 15: 65-68, ill.,

1997). **T**: RSA, Western Cape (*van Jaarsveld & Sajeve* 14628 [NBG]). – **D**: RSA (Western Cape); Succulent Karoo and Valley Bushveld, summer-flowering.

Rounded dwarf branched shrublets to 20 cm (excl. **Inf**); **Br** to 5 mm Ø, old woody with peeling bark; **L** glandular-hairy, green, obovate, 1.5 - 3.4 × 1 - 1.4 cm, both faces convex, margin reddish-purple in the upper ½; **Inf** to 9 cm with 1 - 3 dichasia; peduncle brownish-purple, 2 mm Ø; **Ped** to 18 mm; **Sep** 2.5 × 3 mm with green-purplish markings; **Cl** deep red, tube 12 × 5 - 6 mm Ø, lobes 15 mm, lanceolate, spreading; **Fil** 12 mm, white, flattened; **Anth** flattened, 1 mm Ø; **NSc** square, yellow, fleshy, 1 × 1 mm, spreading-ascending.

C. orbiculata Linné (Spec. Pl. [ed. 1], 429, 1753). **T**: RSA, Western Cape (*Anonymus* s.n. [lecto – icono]: Hermann, Hort. Lugd. Bat. Cat. t. 551, 1687]). – **D**: RSA. **I**: Tölken (1985: 8).

This species grows well in cultivation and is very popular worldwide in warm temperate regions as rockery and bedding plants. It is easily propagated from cuttings and also grows well as a pot plant and is an attractive treasure for any succulent plant collection. The common Afrikaans name is "Plak-kie" (= to stick) and it is often used to get rid of warts. It is exceedingly variable and divided into several poorly differentiated varieties:

C. orbiculata var. **dactyloopsis** Tölken (BT 12(4): 619, 1979). **T**: RSA, Free State (*Smith* 4612 [PRE]). – **D**: RSA (Northern Cape, Free State); dolerite outcrops in grassland, flowers in spring and summer.

Differs from var. *orbiculata*: **Fl** shortly campanulate, yellow with faint reddish striations. Plants decumbent to erect, to ± 15 cm tall; **Br** grey, to 15 mm Ø; **L** densely arranged, grey-green, linear-lanceolate, terete to slightly flattened, to 13 × 1.3 cm, apex acute with red mucro; **Inf** to 28 cm; **Ped** to 15 mm; **Cl** tube 10 × 7 mm Ø at the base, lobes recurved, ± 10 mm; **NSc** slightly tapering 1.5 × 1.5 mm.

C. orbiculata var. **flanagani** (Schönland & Baker fil.) Tölken (BT 12(4): 618, 1979). **T**: RSA, Eastern Cape (*Flanagan* 1317 [GRA, BOL, PRE, SAM]). – **D**: RSA (Eastern Cape); Valley Bushveld, flowers in mid-summer.

≡ *Cotyledon flanagani* Schönland & Baker fil. (1902).

Differs from var. *orbiculata*: Larger erect shrubs to 75 cm tall; **L** in whorls of 3, linear, terete, slightly grooved at the base, to 15.5 × 1 cm, glaucous, apex reddish, mucronate; **Inf** to 22 cm; **Ped** to 20 × 2 mm; **Sep** triangular, 5 × 4 mm; **Cl** 20 - 30 mm, tube to 15 mm, lobes spreading to recurved, 15 mm, orange-red on the inside, duller on the outside; **St** exerted for 5 - 10 mm; **Anth** yellow, 1.5 mm Ø; **NSc** transversely oblong, 1 × 3 mm.

C. orbiculata var. **oblonga** (Haworth) De Candolle (PSRV 3: 396, 1828). **T**: [lecto – icono]: K, t. 792. – **D**: RSA (Northern Cape to Eastern Cape); Bushveld, flowers from winter to spring.

≡ *Cotyledon oblonga* Haworth (1812); **incl.** *Cotyledon canaliculata* Haworth (1819); **incl.** *Cotyledon coruscans* Haworth (1819); **incl.** *Cotyledon undulata* Haworth (1819); **incl.** *Cotyledon canalifolia* Haworth (1825) (*nom. illeg.*); **incl.** *Cotyledon viridis* Haworth (1827); **incl.** *Cotyledon crassifolia* Haworth (1827) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon cuneiformis* Haworth (1828); **incl.** *Cotyledon galpinii* Schönland & Baker fil. (1902); **incl.** *Cotyledon virescens* Schönland & Baker fil. (1902) ≡ *Cotyledon macrantha* var. *virescens* (Schönland & Baker fil.) von Poellnitz (1937); **incl.** *Cotyledon whiteae* Schönland & Baker fil. (1902); **incl.** *Cotyledon whitei* Schönland & Baker fil. (1902); **incl.** *Cotyledon flavida* Fourcade (1934) ≡ *Cotyledon decussata* var. *flavida* (Fourcade) von Poellnitz (1937); **incl.** *Cotyledon leucophylla* C. A. Smith (1934); **incl.** *Cotyledon decussata* var. *rubra* von Poellnitz (1937); **incl.** *Cotyledon obermeyeriana* von Poellnitz (1937); **incl.** *Cotyledon rudatisii* von Poellnitz (1937); **incl.** *Cotyledon zuluensis* Schönland ex von Poellnitz (1937); **incl.** *Cotyledon simulans* Schönland ex von Poellnitz (1940) (*nom. inval.*, Art. 36.1); **incl.** *Cotyledon simulans* var. *spatulata* Schönland ex von Poellnitz (1940) (*nom. inval.*, Art. 36.1, 43.1).

Differs from var. *orbiculata*: **Cl** with a characteristic bulge in the centre. Decumbent to erect shrubs to 60 cm; **Br** basally succulent, to 35 mm Ø, bark grey-green; **L** very variable, mostly oblanceolate, occasionally linear, terete, green to grey, glabrous or hairy, to 13 × 8 cm, base cuneate, apex obtuse, mucronate; **Inf** to 45 cm; **Sep** triangular, 4 mm, tinged red; **Cl** tubular to 35 × 12 mm Ø at the base, tube to 27 mm, orange (rarely yellow), lobes recurved, to 16 mm; **St** not exerted; **Anth** yellow, cordate, 1.5 × 1.5 mm; **NSc** slightly transversely oblong, 1.5 × 2 mm, obtuse, yellowish-green.

The following cultivars are recognized:

'Asgrys': Decumbent short shrublets with tapering short **Br** with shortly truncate smooth shiny phyllopodia; **L** obovate, ash-grey and without red margin.

'Bunny Ears': **Br** low, decumbent, rooting at the nodes; **L** green, oblong-obovate, 17 × 5 cm, with red undulating margin at the tip; **Inf** 20 - 30 cm; **Fl** orange.

'Green Ears': Spreading-ascending shrubs to 30 cm with bright green broadly obovate and often twisted **L** with red margins: **Inf** short, to 14 cm; **Cl** short, 20 mm, distinctly bulging to almost urceolate, orange-red. Common and widely cultivated.

'Green Fingers': Erect to spreading shrublets 12 cm tall; **L** green to yellowish, to 8.5 × 1.2 cm, terete, oblong ovate-lanceolate in outline, apex red, mucronate.

'Grey Sticks': Low decumbent; **L** glaucous, linear-lanceolate, to 22 × 2 cm; **Inf** elongate above the **L**; **Fl** orange.

'Takbok': Low decumbent; **L** glaucous, linear-obovate, to 16 × 2.5 cm with finger-like lobes in the upper part (like a Rain Deer [Takbok]), each lobe with a yellowish mucro; **Fl** orange.

'Tygerfontein': Similar to 'Bunny Ears' but with yellow **Fl**. Originally from Tygerfontein, Eastern Cape.

'Ubombo': Erect subshrubs to 35 cm; **L** hairy, linear-ovate with spatulate tip, apex acute to obtuse, red, mucronate; **Inf** elongating above the **L**; **Cl** 30 mm, orange-red; **St** not exerted. Originally from the Lebombo mountains, KwaZulu-Natal.

C. orbiculata var. **orbiculata** – **D**: S Angola, Namibia, RSA; Fynbos, Succulent Karoo, Grassland, Bushveld, usually on rocky outcrops, flowers in spring and summer. **Fig. IV.e**

Incl. *Cotyledon ramosissima* Miller (1768); **incl.** *Cotyledon mucronata* Lamarck (1786) ≡ *Adromischus mucronatus* (Lamarck) Lemaire (1852) ≡ *Cotyledon undulata* var. *mucronata* (Lamarck) von Poellnitz (1937); **incl.** *Cotyledon unguata* Lamarck (1786); **incl.** *Cotyledon ovata* Haworth (1812) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon elata* Haworth (1819) ≡ *Cotyledon orbiculata* var. *elata* (Haworth) De Candolle (1828); **incl.** *Cotyledon ramosa* Haworth (1819) (*nom. illeg.*) ≡ *Cotyledon orbiculata* var. *ramosa* (Haworth) De Candolle (1828) (*nom. illeg.*); **incl.** *Cotyledon decussata* Sims (1824); **incl.** *Cotyledon tricuspidata* Haworth (1825) ≡ *Cotyledon papillaris* var. *tricuspidata* (Haworth) De Candolle (1828); **incl.** *Cotyledon orbiculata* var. *obovata* De Candolle (1828); **incl.** *Cotyledon orbiculata* var. *rotundifolia* De Candolle (1828); **incl.** *Cotyledon macrantha* Hort. La Mortola ex A. Berger (1900); **incl.** *Cotyledon flanaganii* var. *karroensis* Schönland & Baker fil. (1902); **incl.** *Cotyledon engleri* A. Berger & Dinter (1914) ≡ *Cotyledon orbiculata* var. *engleri* (A. Berger & Dinter) Dinter (1928); **incl.** *Cotyledon ausana* Dinter (1932) ≡ *Cotyledon orbiculata* var. *ausana* (Dinter) H. Jacobsen (1955); **incl.** *Cotyledon orbiculata* var. *oophylla* Dinter (1932); **incl.** *Cotyledon orbiculata* var. *viridis* Dinter ex Range (1934); **incl.** *Cotyledon decussata* var. *dielsii* Schlechter ex von Poellnitz (1937); **incl.** *Cotyledon orbiculata* var. *higginsiae* H. Jacobsen (1952) (*nom. inval.*, Art. 36.1); **incl.** *Cotyledon orbiculata* var. *dinteri* H. Jacobsen (1954) (*nom. inval.*, Art. 36.1); **incl.** *Cotyledon decussata* var. *hinrichseniana* H. Jacobsen (1956).

Erect to decumbent, to 1 m; **L** extremely variable in colour, shape and hairiness, usually glabrous, obovate but also oblong-terete, orbicular, oblanceolate and hairy, to 10.5 × 5 cm, margin often reddish and undulate, base cuneate, apex mucronate; **Inf** to 45 cm; **Cl** tubular but not bulging, to 20 × 9 mm Ø, tube 12 mm, lobes 12 mm, recurved, orange, red or

yellow; **St** exerted for 2 - 3 mm; **Anth** yellow, oblong, 1.75 mm Ø; **NSc** slightly transversely oblong, 1.5 × 2 mm, obtuse, yellowish-green.

This is an exceedingly variable taxon with several distinct local forms recognized as cultivars:

'Bashee': Erect shrubs to 50 cm with tough hairy **L**. Originally from the Bashee River, Eastern Cape.

'Boegoeberg': Rounded branched shrublets to 15 cm; **L** obovate, very succulent, grey, to 3 × 1.8 cm; **Inf** raised above the **L**; **Cl** orange-red. – A very attractive cultivar with small leaves originating from the Richtersveld and adjacent coastal regions, formerly described as *C. orbiculata* var. *oophylla* Dinter. The cultivar name originates from the location in the Sperrgebiet from where it was introduced to cultivation.

'Eric': Rounded subshrubs to 30 cm; **L** green, oblanceolate, 9 × 6 cm with reddish margin at the upper end, apex mucronate. Originally from the Cape Peninsula.

'Ladismith': Rounded shrublets to 30 cm with grey **L** oblanceolate, 5 × 2.5 cm.

'Rolling Edge': Erect shrubs; **L** grey, obovate, margin raised, grey, undulate, apex mucronate. From the E Great and Little Karoo.

'Shireen': Similar to 'Eric' but with grey **L**.

'Stilbay': Erect shrubs to 1 m; **L** grey, to 8 × 4 cm without a red margin, apex mucronate; **Cl** dull yellow. Originally from Stilbaai, Western Cape.

C. orbiculata var. **spuria** (Linné) Tölken (BT 12(4): 619, 1979). **T**: [lecto – icono]: Commelin, Horti Med. Amst. Pl. Rar. fig. 23. – **D**: RSA (Western Cape); Strandveld, Succulent Karoo, flowers in mid-summer.

≡ *Cotyledon spuria* Linné (1762); **incl.** *Cotyledon purpurea* Thunberg (1794).

Differs from var. *orbiculata*: **Inf** elongate, 5 - 120 cm. Plants variable, to 1 m (excl. **Inf**); **Br** to 1 cm Ø at the base; **L** oblanceolate, to 16 × 8.5 cm, glaucous, base cuneate, apex obtuse, mucronate; **Cl** reddish, rarely yellow, to 25 mm, cylindrical and bulging in the middle; lobes recurved; **NSc** emarginate, transversely oblong, 0.75 × 1.75 mm, light yellow.

C. papillaris Linné fil. (Suppl. Pl., 242, 1782). **T**: RSA, Western Cape (*Thunberg* s.n. [UPS [Herb. Thunberg 11011]]). – **D**: RSA (Northern Cape, Western Cape, Eastern Cape); Succulent Karoo, Valley Bushveld, flowers from late spring to summer. **Fig. IV.f**

Incl. *Cotyledon gracilis* Haworth (1819); **incl.** *Cotyledon acaulon* Walther ex Steudel (1840) (*nom. nud.*); **incl.** *Cotyledon meyeri* Harvey (1862); **incl.** *Cotyledon gracilis* Harvey (1862) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon papillaris* var. *robusta* Schönland & Baker fil. (1902); **incl.** *Cotyledon glutinosa* Schönland (1904) ≡ *Cotyledon papillaris* var. *glutinosa* (Schönland) von Poellnitz (1940); **incl.**

Cotyledon glandulosa N. E. Brown (1913); **incl.** *Cotyledon muirii* Schönland (1915); **incl.** *Cotyledon jacobsoniana* von Poellnitz (1936); **incl.** *Cotyledon pseudogracilis* von Poellnitz (1936); **incl.** *Cotyledon papillaris* var. *subundulata* von Poellnitz (1940).

Branched dwarf decumbent to procumbent spreading shrublets to 10 cm; **Br** often rooting when touching the ground; **L** linear-lanceolate to oblanceolate, flattened, occasionally almost terete, yellowish-green to glaucous, 1.5 - 6 × 0.4 - 1.3 cm; **Inf** 10 - 25 cm with 1 - 3 dichasia; peduncle grey-green, to 3 mm Ø at the base; **Ped** 5 mm; **Sep** 3 - 4 mm; **Cl** 15 mm, tube 7 × 4 mm Ø, yellowish-green with purplish spots, lobes 11 - 12 mm, reflexed; **St** 14 mm, exserted; **NSc** orange, rounded, 0.75 × 0.75 mm.

The following cultivars are recognized:

'Grey Mat': **Br** procumbent to prostrate; **L** 2.5 × 0.8 cm, grey-green, linear-oblanceolate, with reddish margin on the upper 1/3. Originally from near the Zuurborg, Eastern Cape.

'Strandfontein': Shrublets with rounded shape and decumbent to erect **Br**.

C. tomentosa Harvey (FC 2: 373, 1862). **T:** RSA, Eastern Cape (*Zeyher* 1085 [S]). – **D:** RSA (Western Cape, Eastern Cape); Succulent Karoo, subtropical thickets, flowers July - September.

C. tomentosa ssp. *ladismithensis* (von Poellnitz) Tölken (BT 12(2): 194, 1977). **T:** RSA, Western Cape (*Pillans* 968 [GRA, BOL]). – **D:** RSA (Western Cape). **I:** *Aloe* 27: 47, 1990.

≡ *Cotyledon ladismithensis* von Poellnitz (1936); **incl.** *Cotyledon heterophylla* Schönland (1907) (*nom. illeg.*, Art. 53.1).

Differs from ssp. *tomentosa*: To 25 cm tall, usually less branched, lower **Br** with brown peeling bark; **L** oblong to oblanceolate, slightly flattened to almost terete, 5 - 8 × 1.5 - 2.5 cm, margin entire, tip acute, mucronate; **Inf** to 15 cm; peduncle to 14 cm, 5 - 6 mm Ø at the base; **Fl** pendulous to spreading; **Cl** tubular, slightly narrowing towards the throat, 18 mm; **Cl** tube light orange to yellowish tinged orange, 12 × 9 mm Ø at the base; **Cl** lobes 8 mm, recurved; **St** exserted for 3 and 6 mm respectively; **Anth** yellow, 1.5 mm Ø, flattened.

C. tomentosa ssp. *tomentosa* – **D:** RSA (Western Cape, Eastern Cape). **I:** *Aloe* 27: 44, 46, 1990.

Dwarf freely branched compact rounded shrublets to 11 cm; **Br** green with long **Ha**; **L** variable in hairiness, shape and marginal teeth, 2.3 - 6.5 × 1.5 - 3.2 cm, oblanceolate to oblong, flattened, green, tomentose, upper 1/3 with 3 - 8 reddish teeth; **Inf** to 16 cm with 1 - 3 dichasia; peduncle reddish, 4 mm Ø at the base; **Ped** 7 - 8 mm; **Sep** green, 6 × 5 mm; **Cl** orange-red, 12 - 16 mm, tube 15 × 9 mm, lobes 10 mm, recurved; **St** exserted for 3 and 5 mm respectively;

Anth yellow, 1.5 mm, flattened; **NSc** green, transversely oblong, 1 × 2 mm.

The following cultivar is notable for the shaggy hairs: 'Wol-ore': **L** 4 × 2.8 cm, with long woolly **Ha**.

C. velutina Hooker fil. (CBM 94: t. 5684 + text, 1868). **T:** [icono]: l.c. t. 5684. – **D:** RSA (Eastern Cape, S KwaZulu-Natal); subtropical thickets, flowers in mid-summer.

incl. *Cotyledon beckeri* Schönland & Baker fil. (1902) ≡ *Cotyledon velutina* var. *beckeri* (Schönland & Baker fil.) Schönland (1915); **incl.** *Cotyledon mollis* Schönland (1915).

Erect succulent shrubs to 3 m; **Br** woody at the base, to 45 mm Ø, with purplish-brown bark peeling in older plants; **L** hairy to glabrous, flat to concave on the upper face, oblanceolate, 5 - 13.5 × 2 - 8 cm, glaucous to green, margin acute, grey-green and decurrent on petiole, base cuneate, auriculate, tip obtuse, mucronate; **Inf** to 60 cm with 3 - 5 dichasia, each with 5 - 10 reddish-yellow glabrous **Fl**; peduncle 3 - 4 mm Ø at the base; **Cl** tubular, tube cylindrical, yellowish, to 17 mm, lobes spreading to recurved; **St** exserted for 7 mm; **Anth** yellow, to 2.5 mm Ø; **NSc** yellow, transversely oblong, 0.6 - 1 mm.

C. woodii Schönland & Baker fil. (*J. Bot.* 40: 21, 1902). **T:** RSA, Cape Prov. (*Wood* s.n. in *Galpin* 5718 [GRA, BM, K]). – **D:** RSA (Western Cape, Eastern Cape); Succulent Karoo, subtropical thickets, flowers mostly in summer and autumn. **Fig. IV.d**

≡ *Cotyledon ramosissima* var. *woodii* (Schönland & Baker fil.) Schönland (1915) ≡ *Cotyledon salmiana* var. *woodii* (Schönland & Baker fil.) von Poellnitz (1936); **incl.** *Cotyledon ramosissima* Salm-Dyck ex Haworth (1819) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon salmiana* von Poellnitz (1936).

Erect branched shrubs to 1.2 m; **Br** woody, with peeling bark, young **Br** green, succulent; **L** obovate, flat, 2 - 5.5 × 1 - 2.5 cm, green or glaucous with reddish margin in the upper 1/2, glabrous or occasionally glandular-hairy, base cuneate, apex mucronate; **Inf** reduced to solitary **Fl** (rarely short dichasia to 7 cm); **Ped** 8 - 10 mm; **Sep** triangular, 5 × 5 mm; **Cl** tubular, slightly tapering towards the throat, orange to red, 12 - 22 × 11 - 15 mm Ø at the base; **Cl** tube yellowish, tinged orange to red; **Cl** lobes recurved, 12 mm; **St** exserted for 3 and 6 mm respectively; **Anth** yellow, oblong, 2.5 mm; **NSc** yellowish, transversely oblong, 1 × 3 mm, emarginate.

The following cultivars are recognized:

'Gamtoos': Erect to rounded subshrubs with sticky **L**. Originally from the Kouga Dam, Eastern Cape.

'Green Eggs': Erect shrublets to 30 cm with shiny green **L** with a red upper margin. Originally from Port Elizabeth, Eastern Cape.

'Grey Eggs': Erect rounded subshrubs with grey smooth **L.** Originally from the Kouga Dam, Eastern Cape.

'Kouga': Shrubs to 10 cm; **Br** glaucous, green; **L** obovate, 4 × 2.5 cm, glaucous, obtuse, mucronate; **Inf** to 8 cm with 1 - 2 dichasia; **Sep** 8 mm; **Cl** 25 mm, tubular, tube green, 10 mm Ø at the base, narrowing to 8 mm Ø towards the throat, lobes 20 mm, reddish. – This is the putative hybrid between *C. woodii* and *C. velutina*.

CRASSULA

E. van Jaarsveld

Crassula Linné (Spec. Pl. [ed. 1], 282, 1753). **T:** *Crassula perfoliata* Linné [Lectotype, Hitchcock, Prop. Brit. Bot., 156, 1929, et errata (based on Dillenius, Hort. Eltham. t. 96: fig. 113, 1732, cf. P. V. Heath, Calyx 3(2): 78, 1993).]. – **Lit:** Tölken (1977); Tölken (1981); Fernandes (1983); Tölken (1983); Bywater & Wickens (1984); Tölken (1985: 75-229); Wickens (1987); Allorge-Boiteau (2002). **D:** Main centre of diversity in S Africa, with minor species numbers in the rest of Africa, scattered taxa throughout the rest of the World. **Etym:** Lat. 'crassus', thick; for the predominantly succulent leaves.

Incl. Tillaea Linné (1753). **T:** *Tillaea muscosa* Linné [Lectotype, selected by inference by De Candolle, Bull. Sci. Soc. Philom. Paris 3: 2, 1801 [only taxon left].].

Incl. Septas Linné (1760). **T:** *Septas capensis* Linné.

Incl. Gomara Adanson (1763). **T:** *Crassula pellucida* Linné [Lectotype according to P. V. Heath, Calyx 3(2): 72, 1993 (based on Dillenius, Hort. Eltham. t. 100: fig. 119, 1732).].

Incl. Bulliarda De Candolle (1801). **T:** *Tillaea aquatica* Linné [Typification according to Britton, Bull. New York Bot. Gard. 3: 1, 1903].

Incl. Rochea De Candolle (1802). **T:** *Crassula coccinea* Linné [Conserved type].

Incl. Larochea Persoon (1805) (*nom. illeg.*, Art. 52.1). **T:** *Crassula coccinea* Linné.

Incl. Dietrichia Trattinnick (1812). **T:** not designated.

Incl. Globulea Haworth (1812). **T:** *Crassula cult-rata* Linné [Lectotype, designated by Tölken, Contr. Bolus Herb. 8: 504, 1977, sub *Crassula* Sect. *Globulea*.].

Incl. Curtogyne Haworth (1821). **T:** *Crassula undata* Haworth [Typification according to Tölken, Fl. South Afr. 14: 158, 1985, sub *Crassula* Sect. *Curtogyne*.].

Incl. Kalosanthes Haworth (1821). **T:** *Crassula jasminea* Haworth ex Sims.

Incl. Purgosea Haworth (1821). **T:** not designated.

Incl. Turgosea Haworth (1821) (*nom. inval.*, Art.

61.1). **T:** *Crassula turrita* [Type according to P. V. Heath, Calyx 5(4): 131, 1997].

Incl. Vauanthes Haworth (1821). **T:** *Crassula dichotoma* Linné [= *Vauanthes chloraefolia* Haworth, *nom. illeg.* Typification according to ING.].

Incl. Dasystemon De Candolle (1828). **T:** *Dasystemon calycinum* De Candolle [Typification by inference, only element included.].

Incl. Grammanthes De Candolle (1828) (*nom. illeg.*, Art. 52.1). **T:** *Crassula dichotoma* Linné.

Incl. Helophytum Ecklon & Zeyher (1836). **T:** *Crassula natans* Thunberg [Typification according to Tölken, Fl. South Afr. 14: 100, 1985, sub *Crassula* Sect. *Helophytum*.].

Incl. Petrogeton Ecklon & Zeyher (1837). **T:** *Petrogeton typicum* Ecklon & Zeyher [Typification according to Tölken, Fl. South Afr. 14: 137, 1985, sub *Crassula* Sect. *Petrogeton*.].

Incl. Pyrgosea Sweet ex Ecklon & Zeyher (1837) (*nom. inval.*, Art. 61.1). **T:** *Crassula turrita* [Type according to P. V. Heath, Calyx 5(4): 131, 1997].

Incl. Sarcolipes Ecklon & Zeyher (1837). **T:** *Sarcolipes pubescens* Ecklon & Zeyher [Typification by inference, only element included.].

Incl. Sphaeritis Ecklon & Zeyher (1837). **T:** *Sphaeritis typica* Ecklon & Zeyher [Typification according to Tölken, Contr. Bolus Herb. 8: 286, 1977].

Incl. Tetraphyle Ecklon & Zeyher (1837). **T:** not designated.

Incl. Thisantha Ecklon & Zeyher (1837). **T:** not designated.

Incl. Disporocarpa (C. A. Meyer) A. Richard (1841) (*nom. inval.*, Art. 34.1c). **T:** not designated.

Incl. Combesia A. Richard (1847). **T:** *Combesia abyssinica* A. Richard [Typification by inference, only element included.].

Incl. Dinacria Harvey (1862). **T:** *Grammanthes filiformis* Ecklon & Zeyher [Typification by inference, only element included.].

Incl. Danielia (De Candolle) Lemaire (1869) (*nom. illeg.*, Art. 53.1). **T:** not designated.

Incl. ×Kalarochea Veitch (1898) (*nom. inval.*, Art. H6.2).

Incl. Hydrophila Ehrhart ex House (1920) (*nom. illeg.*, Art. 52.1). **T:** *Tillaea aquatica* Linné.

Incl. Pagella Schönland (1921). **T:** *Pagella archeri* Schönland.

Incl. Rhopalota N. E. Brown (1931). **T:** *Crassula aphylla* Schönland & Baker.

Incl. ×Rocheassula G. D. Rowley (1973).

Incl. Creusa P. V. Heath (1993). **T:** *Crassula acutifolia* Lamarck.

Incl. Septimia P. V. Heath (1993). **T:** *Crassula spatulata* Thunberg.

Incl. Toelkenia P. V. Heath (1993). **T:** *Cotyledon arborescens* Miller.

Annual or perennial herbs, or dwarf to arbores-

cent shrubs to 2.5 m tall, rarely geophytes with tubers; **R** fibrous to fleshy; **Br** succulent, sometimes becoming woody; **L** decussate, $\pm$ connate within a pair, thickly fleshy to membranous, persistent or deciduous, sessile or shortly petiolate, entire, sheathing basally, glabrous or hairy or papillate, sometimes with conspicuous hydathodes; **Inf** thyrses with solitary to numerous dichasia, sometimes part-**Inf** glomerate, rarely reduced to solitary **Fl**; **Bra** often **L**-like; peduncle present or indistinct with **Bra** shorter or as long as the **L**; **Fl** (2- to) 4- to 5- (to 12-) merous, haplostemonous, mostly small; **Sep** (2-) 4- 5 (-12), fused shortly at the base; **Pet** (2-) 4 - 5 (-12), shortly connate basally, tips often appendaged; **St** in a single whorl, basally adnate to **Pet** and alternate with them; **Anth** included or exerted, without terminal appendage; **NSc** flat to thickish; **Ca** free to slightly immersed into the **Rec** and gradually constricted into short or long **Sty** terminating in single **Sti**; **Se** ellipsoid, smooth or tuberculate, tubercles sometimes in longitudinal rows.

Crassula rivals with *Sedum* for being the largest genus of the family. Its distribution is predominantly in the S hemisphere with $\pm$ 150 species alone in S Africa. The genus can be divided into 2 subgenera, Subgen. *Disporocarpa* Fischer & C. A. Meyer 1841 (annuals or perennials; embracing sections 1 - 9 in the list below) and Subgen. *Crassula* (perennials; embracing sections 10 - 20). The differences between the subgenera (and to a lesser extent between the sections) are far from clear-cut, however, and no unambiguous lines of evolution can be recognized throughout the genus. The S African species of the genus were monographed by Tölken (1977, 1985), and these publications are followed in general. The descriptions for S African taxa are based on Tölken (1985) but are supplemented from plants in the living collections at Kirstenbosch whenever possible. The descriptions of the other taxa were mostly compiled from the literature sources given above for the genus.

Crassula shows no close affinities with other genera of the family and occupies a subfamily of its own, *Crassuloideae*. The genus *Tillaea* (dwarf annual or perennial herbs, widespread esp. in the S hemisphere) is here included as synonym (see Sect. *Helophytum*), but arguments have recently been put forward on molecular grounds to recognize the group at generic rank ('t Hart 1995).

Sectional Classification:

- [1] Sect. *Helophytum* (Ecklon & Zeyher) Tölken 1977 (syn. *Tillaea*): Mainly soft rhizomatous annuals and often aquatics, or rarely perennials with solitary axillary (3- to) 4-merous **Fl**; **Cal** $\frac{1}{2}$ as long as **Cl**, **Cl** cup-shaped, lobes with obtuse tips without appendages.
A section at once distinguished from the other sections by the solitary flowers in the leaf axils. According to Tölken (1985) the inflorescence is

a highly reduced thyrses with dichasia reduced to monochasial end branches, or the whole plant consists of monochasia with leaf-like bracts.

Widespread in S Africa, esp. in the winter rainfall regions and also all along the E escarpment mountains, but also represented throughout the world in temperate to tropical climates.

- [2] Sect. *Glomeratae* Haworth 1821: **Br** softly herbaceous or stiff and erect, **L** flat to terete; **Inf** thyrses with **L**-like **Bra** and 5-merous (rarely 2-, 3- or 4-merous) **Fl** in upper parts; **Cal** $\geq$ **Cl**, tips acute; **Cl** cup-shaped, lobes without dorsal appendage; **Fr** opening apically or with a basal circumscissile split.

This section consists of some 26 species, most of which are small delicate annuals. It is a very variable group and needs further study. It is widespread in Africa (centred in the S), but occurs also in India and Australia.

- [3] Sect. *Dinacria* (Harvey) Schönland 1890: Erect annuals with thin **Br**; **R** fibrous; **L** flat, sessile; **Inf** terminal thyrses with several dichasia, peduncle absent; **Fl** 5-merous; **Cl** tubular to cup-shaped, lobes without dorsal appendage.

A small section with only 5 species mainly confined to the Cape region (N & W parts of the Eastern Cape) and characterized by their tubular flowers in terminal sessile cymes.

- [4] Sect. *Filipedes* (Harvey) Schönland 1890: Perennials (rarely annuals); **Br** herbaceous, $\pm$ fleshy or slightly woody; **L** sessile to petiolate, flat or terete; **Inf** thyrses with few-flowered cymes to solitary **Fl**; **Fl** 5-merous; **Cl** $\pm$ cup-shaped, lobes smooth and without appendages.

A small section of 4 species widely distributed from Tropical Africa to the Western Cape and Madagascar. The prostrate growth and usually solitary flowers in the leaf axils (rarely crowded at stem tips) are characteristic.

- [5] Sect. *Deltoideae* De Candolle 1828: Perennials with short **Br** to 10 cm; **L** verrucose, angular; **Inf** fascicled thyrses or dichasia with indistinct peduncle; **Cl** urceolate, lobes subacute; **Ca** almost pyriform.

A small section with 4 species widely distributed from S Namibia and the Free State to the Northern and Western Cape. They are characterized by leaves with a rough surface and papillate seeds.

- [6] Sect. *Anacampseroideae* Haworth 1821: Perennials (*C. pelludica* ssp. *spongiosa* annual) varying from prostrate herbs to erect thick-stemmed shrubs to 2.5 m tall; **L** flattish, sessile to petiolate, with distinct marginal hydathodes; **Inf** thyrses or dichasia; **Fl** (4- to) 5-merous, stellate; **Pet** tips with appendages.

This section consists of 11 species confined to forested areas and thickets of the S and E parts of RSA and extends to the SW Cape region.

- [7] Sect. *Petrogeton* (Ecklon & Zeyher) Walpers

- 1843: Geophytes with subterranean tuber with **R** and deciduous **Br** and **L**; **L** in up to 6 pairs, sometimes those of a pair fused into a single large orbicular **L**; **Cl** stellate with short tube, lobes without appendages.
This is a small section with 9 species mainly from the winter rainfall regions of the Northern and Western Cape and the Drakensberg region of KwaZulu-Natal. They are immediately recognized by their underground tubers.
- [8] Sect. *Galpiniflora* Tölken 1977: Perennials with short fleshy stems with apical **Ros**; **Inf** lax dichasia (often ending in monochasia) from the **Ax** of the lower **L** of the **Ros**; **Fl** 5-merous; **Cl** stellate, lobes smooth and without appendages.
This small section embraces only a single taxon (*C. peploides*) from high altitudes in NE RSA. The inflorescence architecture and position is unique for this section.
- [9] Sect. *Acutifolia* (Schönland) Tölken 1977: Perennials with slightly fleshy (rarely wiry or slightly woody) often papillate **Br**; **Inf** thyrses with or without peduncles; **Fl** 5-merous; **Cl** tubular, lobes smooth and rarely with appendages.
A small section with a S African distribution, characterized by sessile subulate leaves and ridged petals.
- [10] Sect. *Squamulosae* Haworth 1821: Perennials with $\pm$ woody **Br**; **L** usually with tough and often blister-like **Ha**, rarely glabrous, marginal cilia $\pm$ conspicuous; **Inf** thyrses (sometimes broken into cymose clusters) without distinct peduncle; **Fl** 5-merous; **Cl** tubular, lobes with dorsal ridges and distinct appendages.
Widespread in the Western and Northern Cape as well as in S Namibia and characterized at once by the appressed leaves and young leaves with marginal cilia.
- [11] Sect. *Subulares* Haworth ex De Candolle 1828: Perennials; **Br** $\pm$ woody; **L** mostly linear to oblong, glabrous, margins ciliate; **Inf** $\pm$ distinctly pedunculate thyrses; **Fl** 5-merous; **Cl** tubular, 3 - 4.5 mm long; **Pet** usually stiff, often acuminate, without dorsal appendage; **Ca** usually abruptly constricted into the **Sty**.
Small section with 5 species from the Western and Eastern Cape, differing from Sect. *Curtoogyne* by petals only 2.5 - 4.5 mm long and without dorsal appendage, and oblong nectary scales.
- [12] Sect. *Curtoogyne* (Haworth) Tölken 1977: Perennials with $\pm$ woody **Br**; **L** glabrous, margins ciliate; **Inf** thyrses, usually with indistinct peduncle; **Fl** 5-merous; **Cl** tubular, 5 - 9 mm; **Pet** membranous or almost so, acute, tips with dorsal appendage; **Ca** gradually constricted into the long **Sty**.
Small section with only 4 species widespread in the Northern, Western and Eastern Cape, differing from Sect. *Subulares* by petals 5 - 9 mm long and transversely oblong nectary scales.
- [13] Sect. *Kalosanthos* (Haworth) Tölken 1977: Perennials; **Br** succulent to $\pm$ woody; **L** $\pm$ flattened, glabrous, margins ciliate; **Inf** capitate thyrses without distinct peduncle; **Fl** 5-merous; **Cl** tubularly salver-shaped, 2 - 6 cm long, **Pet** tips acuminate with dorsal appendage; **Ca** gradually tapering into slender **Sty**, with > 50 ovules.
A small section with only 3 species from the Western Cape, characterized by their long salver-shaped flowers.
- [14] Sect. *Rosulares* Haworth 1821: Perennials (rarely annuals, e.g. *C. southii*), stems succulent, elongating when flowering but otherwise short to almost absent and **L** in basal often clustered **Ros**; **L** usually flat, obvolvate in buds, margins often with recurved ciliae; **Inf** sessile or pedunculate thyrses, **L** gradually shorter from bottom to top; **Fl** 5-merous; **Sep** tips often with solitary apical **Ha**; **Cl** tubular, lobes $\pm$ papillose and with dorsal appendage; **Ca** gradually tapering into the **Sty**.
This section counts about 2 dozen species widespread in S Africa with a concentration in the SE Cape region. It is at once characterized by the rosulate and flat leaves with acute to acuminate tips.
- [15] Sect. *Perfilatae* Haworth ex De Candolle 1828: Perennials with somewhat woody stems; **L** $\pm$ tough, at least young **L** with marginal cilia; **Inf** normally with short but distinct peduncle; **Fl** 5-merous; **Cl** tubular, lobes $\pm$ papillose, often with small dorsal appendage.
A small section with 6 species from S Namibia and the Northern, Western and Eastern Cape. Typical are the woody glabrous stems and sessile leaves basally fused within a pair to form a leaf sheath.
- [16] Sect. *Columnares* Haworth ex De Candolle 1828: Perennial or biennial monocarpic dwarf succulents to 15 cm tall; **R** fibrous (rarely tuberous); **L** sessile, compact and densely imbricate and forming a columnar pseudo-stem; **Inf** dense terminal cymose capitula; **Fl** 5-merous; **Cl** tubular with smooth lobes lacking terminal appendages; **Ca** conical.
A small section with 6 species mainly confined to the winter rainfall Succulent Karoo regions of the Northern and Eastern Cape. *C. pyramidalis* enters the summer rainfall region of the Eastern Cape. This section is immediately distinguished by the columnar pseudo-stems and tubular flowers in a dense terminal capitulum. The plants usually die after flowering but lower side branches often continue growth.
- [17] Sect. *Argyrophylla* (Schönland) Tölken 1977: Perennial decumbent clusters or erect shrublets to 20 cm tall with hairy to papillate flattened

to terete clustered **L**; **Inf** terminal pedunculate thyrses with 1 or many dichasia; **Fl** 5-merous; **Cl** tubular, lobes aculeate and with dorsal appendages (rarely without); **Ca** reniform.

A widespread section of 12 species occurring from Malawi to the Cape, with a centre in the Succulent Karoo of the winter rainfall region in the Western and Northern Cape. It differs from Sect. *Arta* by the lax inflorescence and flowers shorter than 2.5 mm.

- [18] Sect. *Arta* (Schönland) Tölken 1977: Perennials; stems succulent; **L** usually densely clustered in a columnar **Bo**; **Inf** round-topped terminal thyrses with spreading dichasia; **Fl** 5-merous; **Cl** tubular, ± 3 mm, lobes aculeate with dorsal appendages; **Ca** ampulliform with red **Sti**.

This small section with 5 species is confined to the S Namib Desert in Namibia and N RSA (Northern Cape, Western Cape). All occur in Succulent Karoo and are characterized by flowers ± 3 mm long and ampulliform carpels with broad terminal stigmas.

- [19] Sect. *Crassula*: Perennials with $\pm$ woody stems, covered with coarse rounded papillae; **L** tough and fleshy, often $\pm$ falcate, opposite and distichous; **Inf** terminal rounded pedunculate thyrses; **Fl** 5-merous; **Cl** tubular, **Pet** aculeate, with pointed dorsal appendage; **Ca** reniform. Comprises the single polymorphic *C. perfoliata*, widespread from the SE Cape region to SE Tropical Africa, and characterized by long woody stems and pedicellate flowers.

- [20] Sect. *Globulea* (Haworth) Harvey 1862: Perennials; **Br** often $\pm$ woody; **L** often $\pm$ falcate; **Inf** elongate to rounded terminal thyrses with **Br** ending in globose dichasia; **Fl** 5-merous, sessile or almost; **Cl** tubular-urceolate, scarcely opening, lobes stiffly erect, their smooth dorsal appendages much enlarged and overtopping their tips, rarely with a stiffly erect beak.

A section with 13 species widespread in the Northern, Western and Eastern Cape, Free State, KwaZulu-Natal and S Namibia, distinguished by its prominent fleshy petal appendages or fleshy petal tips.

Tölken (1985) reports numerous interspecific hybrids.

The following names are of unresolved application but are referred to this genus: *Crassula adscendens* Thunberg (1778); *Crassula caffra* Linné (1771); *Crassula capensis* var. *leipoldtii* Schönland (1929) $\equiv$ *Septas capensis* var. *leipoldtii* (Schönland) P. V. Heath (1993); *Crassula concinella* Haworth (1823) $\equiv$ *Purgosea concinella* (Haworth) Sweet (1830); *Crassula concinna* Haworth (1821) $\equiv$ *Purgosea concinna* (Haworth) Sweet

(1830); *Crassula crenatifolia* Baker fil. (1906); *Crassula diffusa* Aiton (1789); *Crassula fruticulosa* Linné (1767); *Crassula goetzeana* Engler (1907); *Crassula mariae* hort. München (H.-C. Friedrich ms. ?) (s.a.) (*nom. inval.*, Art. 29.1); *Crassula procumbens* Rojas Acosta (1897); *Crassula pulchella* Aiton (1789); *Crassula punctata* Linné (1759) $\equiv$ *Purgosea punctata* (Linné) Sweet (1830); *Crassula revolvens* Haworth (1824) $\equiv$ *Creusa revolvens* (Haworth) P. V. Heath (1993); *Crassula saxatilis* H.-C. Friedrich ms. (s.a.) (*nom. inval.*, Art. 29.1); *Crassula striata* Schönland in sched. (s.a.) (*nom. inval.*, Art. 29.1); *Crassula venusta* H.-C. Friedrich ms. (s.a.) (*nom. inval.*, Art. 29.1); *Globulea linguifolia* Haworth (1821); *Globulea lingula* Haworth (1826); *Tillaea stuartii* F. Mueller (1853).

C. acinaciformis Schinz (Bull. Herb. Boissier 2: 204, 1894). **T**: RSA, Northern Prov. (*Rehmann* 6375 [Z, K]). – **D**: RSA (Northern Prov., Mpumalanga, KwaZulu-Natal), Swaziland; shallow soil among granite outcrops in grassland, flowers mid-summer to autumn.

Incl. *Crassula alooides* N. E. Brown (1896) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula inaequalis* Schönland (1913).

[14] Rosulate, usually solitary or proliferating from the base to form small groups, to 1.3 m tall (**incl. Inf**); **L** 8 - 40 $\times$ 3 - 10 cm, spirally arranged, flattened, lanceolate to linear-lanceolate, upper face channelled, glabrous, green to yellowish-green, margin ciliate, tip acute; **Inf** erect terminal flat-topped thyrses with many dichasia; **Bra** **L**-like, becoming shorter upwards; **Fl** pedicellate; **Sep** to 1.5 mm, broadly triangular, margin sparingly toothed, tips with apical sturdy **Ha**; **Cl** dull yellow, cup-shaped, to 5 mm; **Pet** oblong-obovate, to 4 mm, fused shortly at the base, spreading to recurved, tips rounded and slightly cucullate; **Anth** yellow.

C. alata (Viviani) A. Berger (NPF2 18a: 389, 1930). **T**: Egypt (*Viviani* s.n. [GE]). – **D**: S Europe to Ukraine, Mediterranean, N and NE Africa, Arabian Peninsula to India.

$\equiv$ *Tillaea alata* Viviani (1830).

C. alata ssp. *alata* – **D**: E Mediterranean (Greece, Cyprus) to NE India, NE Africa S-wards to Sudan; introduced to S Australia (Victoria, New South Wales).

Incl. *Tillaea trichopoda* Fenzl ex Boissier (1872) (*nom. illeg.*, Art. 52.1) $\equiv$ *Tillaea muscosa* var. *trichopoda* (Fenzl) Post (1896) (*nom. illeg.*, Art. 52.1) $\equiv$ *Crassula alata* var. *trichopoda* (Fenzl) Maire (1977) (*nom. illeg.*, Art. 52.1); **incl.** *Tillaea muscosa* subvar. *pentamera* Jahandiez & Maire (1923) $\equiv$ *Crassula alata* subvar. *pentamera* (Jahandiez & Maire) Maire (1977); **incl.** *Crassula tripartita* N. A. Wakefield (1957).

[2] Erect glabrous little branched annuals to 12

cm tall; **Br** slender, terete, reddish, to 0.5 mm Ø, winged; **L** 3 - 7 × 1 - 2 mm, sessile, lanceolate, acuminate, tip aristate, white, bases of opposite **L** fused forming a non-saccate sheath to 0.5 mm high; **Inf** cymose, leafy, reduced to 2 **Fl** per **Ax**; **Ped** to 4 mm; **Fl** 3- to 4-merous; **Sep** lanceolate, pale green, to 1.5 × 0.2 mm, connate at the base, tip with white **Bri**; **Pet** narrowly ovate, acuminate, white, membranous, 0.8 × 0.3 mm; **Fil** to 0.5 mm; **Anth** suborbicular, yellow; **Ca** obliquely obovoid, to 0.7 mm, constricted into the short **Sty**; **Se** 2 per **Ca**, to 0.4 mm, yellow-brown, longitudinally ribbed.

C. alata ssp. **pharnaceoides** (Fischer & C. A. Meyer) Wickens & Bywater (KB 34(4): 633, 1980). **T**: Ethiopia, Tigre Region (*Schimper* I:104 [LE, B, BM, G, GRA, K, P, SJ]). – **D**: NE and E Africa (Ethiopia, Cameroon, Sudan, Kenya, Somalia, Uganda); shaded bare or moss-covered earth banks. **I**: Gilbert (1989: 7).

≡ *Crassula pharnaceoides* Hochstetter ex Fischer & C. A. Meyer (1841) ≡ *Disporocarpa pharnaceoides* (Fischer & C. A. Meyer) Schweinfurth & Ascherson (1867) (*nom. inval.*, Art. 43.1) ≡ *Crassula campestris* ssp. *pharnaceoides* (Fischer & C. A. Meyer) Tölken (1975) ≡ *Combesia campestris* var. *pharnaceoides* (Fischer & C. A. Meyer) P. V. Heath (1993); **incl.** *Tillaea pharnaceoides* Steudel (1841) (*nom. inval.*, Art. 32.1c); **incl.** *Combesia abyssinica* A. Richard (1847) (*nom. illeg.*, Art. 52.1); **incl.** *Crassula pharnaceoides* ssp. *eu-pharnaceoides* Merxmüller (1951) (*nom. inval.*, Art. 21.3).

[2] Differs from ssp. *alata*: **Fl** 5-merous.

C. alba Forsskål (Fl. Aegypt.-Arab., 60, 1775). **T**: Arabia (*Forsskål* 691 [C]). – **D**: E to S Africa.

Incl. *Crassula ellenbeckiana* Schönland (s.a.).

C. alba var. **alba** – **D**: E Africa from Ethiopia to RSA (Eastern Cape); high-montane grasslands, flowers mid-summer to autumn. **I**: Tölken (1985: 175, fig. 17:1).

Incl. *Crassula rubicunda* var. *rubicunda*; **incl.** *Rochea dichotoma* Hochstetter in herb. *Schimper* (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Rochea vaginata* Hochstetter in herb. *Schimper* (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Crassula puberula* R. Brown (1814) (*nom. inval.*, Art. 32.1c); **incl.** *Globulea stricta* Drège (1843) (*nom. inval.*, Art. 32.1c); **incl.** *Crassula abyssinica* A. Richard (1847); **incl.** *Crassula rubicunda* Drège ex Harvey (1862); **incl.** *Crassula recurva* N. E. Brown (1890); **incl.** *Crassula milleriana* Burt Davy (1926) ≡ *Crassula rubicunda* var. *milleriana* (Burt Davy) Schönland (1929); **incl.** *Crassula stewartiae* Burt Davy (1926); **incl.** *Crassula rubicunda* var. *flexuosa* Schönland (1929); **incl.** *Crassula rubicunda* var. *hispida* Schönland (1929); **incl.** *Crassula rubicunda* var. *subglabra* Schönland (1929); **incl.** *Crassula rubicunda* var. *typica* Schönland (1929).

[14] Rosulate, usually solitary or proliferating from the base to form small groups, to 50 cm tall (**incl.** **Inf**); **R** slightly fleshy; **L** 6 - 17 × 0.5 - 1.5 cm, spirally arranged, flattened, lanceolate to linear-lanceolate, upper face folded to channelled, glabrous, green to yellowish-green, sometimes with purple spots, lower face purplish, margin ciliate, tip acute; **Inf** erect terminal flat-topped thyrses with many dichasia; **Bra** L-like, becoming shorter upwards; **Fl** pedicellate; **Sep** to 5 mm, narrowly to broadly triangular, margin distinctly ciliate, tips with apical sturdy **Ha**; **Cl** red to white, tubular, to 6 mm, erect; **Pet** oblong-obovate, to 5.5 mm, fused shortly at the base, spreading to recurved, tips acute and slightly cucullate; **Anth** dark brown; **Ca** with 14 - 30 ovules.

C. alba var. **pallida** Tölken (BT 12(4): 634, 1979). – **D**: RSA (Mpumalanga), NE Swaziland; above cliffs on rocky ledges, autumn-flowering.

[14] Differs from var. *alba*: **Sep** short, glabrous, to 2 mm, not tapering into a sharp point, with few marginal teeth; **Cl** to 4 mm; **Pet** spreading, cream to yellowish.

C. alba var. **parvisepala** (Schönland) Tölken (JSAB 41: 93, 1975). **T** [lecto]: RSA, Mpumalanga (*Wilms* 538 [GRA, BM, E, G, K, KFTA, P, Z]). – **D**: RSA (Mpumalanga), NE Swaziland; mountainous grassland rock outcrops, flowers mid-summer to autumn.

≡ *Crassula rubicunda* var. *parvisepala* Schönland (1929); **incl.** *Crassula similis* Baker fil. (1903) ≡ *Crassula rubicunda* var. *similis* (Baker fil.) Schönland (1929); **incl.** *Crassula atrosanguinea* Beauverd (1907); **incl.** *Crassula wilmsii* Diels (1907); **incl.** *Crassula rubicunda* var. *lydenburgensis* Schönland (1929).

[14] Differs from var. *alba*: **Sep** short, glabrous, to 3 mm, not tapering into a sharp point, sometimes with few marginal teeth; **Cl** to 3.5 mm; **Pet** recurved; **Ca** with 8 - 10 ovules.

C. alcornis Schönland (Ann. Bolus Herb. 2: 93, 1917). **T**: RSA, Western Cape (*Bolus* s.n. in *BOL* 14815 [GRA, BOL, STE]). – **D**: RSA (Western Cape); on quartzitic sandstone rocks, flowers mid-winter.

≡ *Septas alcornis* (Schönland) P. V. Heath (1993).

[7] Geophytes with erect unbranched stems to 12 cm; rhizome branched with several globose tubers with fibrous adventitious **R**; **L** in 1 - 2 pairs, flattened, palmately lobed, sessile, lobes 2 - 4 cm long, surface glabrous, green, rarely purplish below, tip subacute; **Inf** terminal rounded thyrses; peduncle to 6 cm; **Sep** triangular-lanceolate, to 1.5 mm; **Cl** tubular, 5-merous, white, tinged pink, lobes lanceolate to elliptic, to 3.5 mm, tips subacute, spreading to recurved; **Anth** brown.

C. alpestris Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 329, 336, t. 5b: fig. 4, 1778). **T:** RSA, Western Cape (*Thunberg* 7727 [UPS, LU, S]). – **D:** RSA.

≡ *Purgosea alpestris* (Thunberg) G. Don (1834) ≡ *Tetraphyle alpestris* (Thunberg) P. V. Heath (1993).

C. alpestris ssp. **alpestris** – **D:** RSA (Western Cape); mountains in shallow rock pockets.

[16] Monocarpic, solitary or sparingly branched, 5.5 - 10 cm tall (incl. **Inf**); **R** fibrous; **Br** erect, to 5 mm Ø at base, reddish; **L** 10 - 20 × 4 - 6 mm, triangular, often overlapping, becoming smaller upwards, dark green and often covered with sand and dust, margin ciliate, tip acute; **Inf** terminal single to branched flat-topped dichasia to 9 cm tall; **Bra** **L**-like, triangular, 6 × 5 mm, ciliate; **Sep** 2.5 - 4 mm, triangular-lanceolate, ciliate; **Cl** tubular, 7 mm, lobes oblong, fused in the lower 2 mm, white, tips spreading.

C. alpestris ssp. **massonii** (Britten & Baker fil.) Tölken (JSAB 41: 93, 1975). **T:** RSA, Western Cape (*Masson* s.n. [BM, PRE [photo]]). – **D:** RSA (Western Cape); Dry Fynbos and Succulent Karoo, spring-flowering.

≡ *Crassula massonii* Britten & Baker fil. (1897) ≡ *Tetraphyle alpestris* var. *massonii* (Britten & Baker fil.) P. V. Heath (1993); incl. *Crassula variabilis* N. E. Brown (1901).

[16] Differs from ssp. *alpestris*: Larger, 8 - 25 cm tall; **L** triangular, 4 - 8 × 3 - 7 mm, not as tightly packed; **Inf** rounded, axillary and terminal; **Fl** sweet-scented.

C. alstonii Marloth (Trans. Roy. Soc. South Afr. 1: 404, t. 27: fig. 7, 1910). **T** [lecto]: RSA, Northern Cape (*Alston* s.n. in *Marloth* 4679 [GRA]). – **D:** RSA (Northern Cape); Succulent Karoo, quartz gravel flats. **I:** Tölken (1985: 203, fig. 19: 1).

[17] Monocarpic, dwarf, compact, 1-stemmed or sparingly branched from the base, to 4 cm tall; **R** fibrous; **Br** ± 3 mm Ø, axis hidden by the tightly clasping imbricate **L** pairs, these basally not fused and becoming shorter upwards, in their entirety forming a quadrangular-cylindrical to globose **Bo** to 3.5 cm Ø with rounded apex; **L** transversely compressed, obtriangular-obovate, grey-green, velvety, 12 - 15 × 12 - 22 mm, margin minutely ciliate and with a ring of hydathodes, upper face flat or concave, lower face convex, bulging at the tips, tips rounded; **Inf** terminal rounded thyrses; peduncle to 4 cm; **Sep** to 2 mm, yellowish-green, with recurved **Ha**; **Cl** tubular, to 3 mm, lobes shortly fused at the base, cream to pale yellow, oblong-lanceolate, acuminate; **Anth** brown to yellow.

C. alticola R. Fernandes (Bol. Soc. Brot., sér. 2, 52: 182-186, 1978). **T:** Zimbabwe (*Mendes & Wild* 217 [LISC, BM, SRGH]). – **D:** E Zimbabwe, W Mo-

cambique; Afro-temperate forests, 1900 - 2400 m. **I:** Fernandes (1983: 16, t. 3).

[6] Decumbent to erect sparingly branched herbs with **Br** to ± 35 cm, often rooting at the nodes; **R** fibrous; **Br** terete, sometimes 4-angled in short axillary branchlets, green, to 1.5 mm Ø, glabrous except for 2 vertical rows of papillose **Ha**; **Int** to 1 cm; **L** 1 - 5 × 0.7 - 2 cm, dark green, obovate to elliptic, acute, margins entire, base cuneate and fused shortly with the opposite **L** of the pair; **Inf** terminal dichasia; peduncles shortly papillose-pilose; **Ped** to 15 mm (usually much shorter); **Sep** oblong, to 3.5 mm, subacute; **Cl** stellate, white, to 10 mm Ø; **Pet** oblong-lanceolate, acute, 3 × 2 mm; **Fil** 2 mm; **Anth** yellow.

A member of the variable *C. pellucida*-complex.

C. ammophila Tölken (JSAB 41: 94-95, 1975). **T:** RSA, Northern Cape (*Pearson* 5501 [GRA, K]). – **D:** RSA (Northern Cape, Western Cape); Strandveld and Succulent Karoo, flowers spring to midsummer.

≡ *Globulea ammophila* (Tölken) P. V. Heath (1995).

[20] Erect brittle sparingly branched shrublets to 80 cm tall, sometimes scandent in the surrounding vegetation; **R** fibrous; old **L** persistent; **L** 8 - 15 × 3 - 4 mm, oblong-lanceolate, flattened, grey- to brownish-green, with dense coarse recurved **Ha**, upper face flat to slightly convex, lower face convex, tips obtuse to acute; **Inf** elongated thyrses with rounded shortly pedunculate dichasia; **Sep** triangular, to 2.5 mm, acute, margin ciliate; **Cl** tubular, cream, lobes shortly fused basally, panduriform with beak-like tips; **Anth** black.

C. aphylla Schönland & Baker fil. (J. Bot. 36: 371, 1898). **T:** RSA, Cape Prov. (*Schlechter* 8665 [GRA, BM, BOL, E, G, K, LE, P, PRE, S, SAM, Z]). – **D:** RSA (Western Cape, Northern Cape); Fynbos mountain tops, in shallow rock pockets, flowers in spring.

≡ *Rhopalota aphylla* (Schönland & Baker fil.) N. E. Brown (1931).

[1] Soft erect glabrous reddish succulent annual herbs 1.5 - 3 cm tall; **R** fibrous; central **Br** larger, club-shaped, ± 1 mm Ø; **L** reduced to a swollen fleshy ring at the **Int** or occasionally minutely triangular-lanceolate, erect, to 1.5 mm with acute tips, upper face flat, lower face convex; **Ped** to 1.5 mm; **Fl** to 1.5 mm; **Cal** a fleshy ring with indistinct to triangular lobes; **Cl** white to pink, cup-shaped, lobes loriate-ovate, to 2 mm, tips obtuse, recurved; **Anth** brown.

C. aquatica (Linné) Schönland (in Engler & Prantl (eds.), Nat. Pfl.-fam. [ed. 1], 3(2a: 37): 891, 1891). **T:** Europe (*Anonymus* s.n. [BM]). – **Lit:** Jalas & al. (1999: 43). **D:** N and E Europe, N Asia, N America from Alaska and Newfoundland to California;

brackish mud flats, intertidal zones, swamps, $\pm$ sub-aquatic. **I:** Bywater & Wickens (1984: 705, fig. 1:F-K).

$\equiv$ *Tillaea aquatica* Linné (1753) $\equiv$ *Bulliarda aquatica* (Linné) De Candolle (1828) $\equiv$ *Tillaeastrum aquaticum* (Linné) Britton (1903) $\equiv$ *Hydrophila aquatica* (Linné) House (1920) (*incorrect name*, Art. 11.4); **incl.** *Tillaea prostrata* Schkuhr (1794); **incl.** *Tillaea simplex* Nuttall (1817); **incl.** *Tillaea ascendens* Eaton (1818); **incl.** *Tillaea angustifolia* Nuttall ex Torrey & Gray (1840); **incl.** *Bulliarda borealis* Gandoger (1886) (*nom. inval.*, Art. 24.1); **incl.** *Elatine tetrandra* Maximowicz (1888).

[1] Minute erect to decumbent herbs, aquatic **Br** to 10 cm; **L** elliptic-ob lanceolate, 3 - 6.5 mm, acute to obtuse; **Fl** 1 per node, 4-merous; **Ped** < 1 mm; **Sep** triangular to obtuse, 0.6 - 0.9 $\times$ 0.7 - 0.8 mm, occasionally with black glandular dots; **Pet** rhomboid-ovate, 1.4 - 1.7 $\pm$ 0.8 mm, 2 $\times$ as long as the **Sep**; **NSc** filiform-spatulate, 0.8 mm; **Se** (5-) 9 - 12 per **Ca**, oblong-ellipsoid, longitudinally striate, minutely rugulose.

The Chinese taxa *Tillaea yunnanensis* S. H. Fu 1965 and *T. likiangensis* H. Chuang 1997 need a proper evaluation to ascertain their relationships. Neither of the 2 names has been transferred to *Crassula* so far. *T. yunnanensis* is said to differ from *C. aquatica* by clearly pedicellate flowers with longer sepals and yellow petals. *T. likiangensis* allegedly differs by smaller flowers and pale rose-coloured petals. Both taxa occur in high-altitude swamps (2700 m) in the Chinese province of Yunnan. – [U. Eggli]

C. arborescens (Miller) Willdenow (Spec. Pl. 1(2): 1554, 1798). **T** [neo]: RSA, Western Cape (*Tidken* 4220 [BOL]). – **D:** RSA.

$\equiv$ *Cotyledon arborescens* Miller (1768) $\equiv$ *Toelkenia arborescens* (Miller) P. V. Heath (1993).

C. arborescens ssp. **arborescens** – **D:** RSA (Western Cape, Eastern Cape, S KwaZulu-Natal); Succulent Karoo, dry rock outcrops on warm slopes, flowers spring to mid-summer.

Incl. *Crassula cotyledon* Jacquin (1781); **incl.** *Crassula arborea* Medikus (1783); **incl.** *Crassula cotyledonifolia* Salisbury (1796) (*nom. illeg.*, Art. 52.1).

[6] Erect branched shrubs to 1.5 m tall, usually with a single main stem to 6 cm $\varnothing$; **Br** succulent, grey-green, **L**-bearing **Br** 7 - 10 mm $\varnothing$, older **Br** with yellowish-brown peeling bark, distinctly articulate at the nodes; old **L** deciduous; **L** 3.2 - 7 $\times$ 2.3 - 4.2 cm, flat, obovate to obovate-orbicular, ascending, glaucous with powdery bloom, and often spotted with conspicuous hydathodes, margins reddish, base cuneate, tip obtuse, mucronate or not; **Inf** terminal round-topped thyrses 5 - 8 cm tall with numerous dichasia; peduncle 15 - 30 $\times$ 4 mm; **Ped** 10 - 12 mm; **Sep** broadly triangular; **Cl** stellate, 18 -

20 mm $\varnothing$, light pink or white; **Pet** 9 - 10 $\times$ 2.5 - 3 mm, lanceolate; **Fil** 5 - 6 mm; **Anth** < 1 mm, purplish.

C. arborescens ssp. **undulatifolia** Tölken (JSAB 41: 95, 1975). **T:** RSA, Eastern Cape (*Tidken* 4290 [BOL]). – **D:** RSA (Eastern Cape); Valley Bushveld, rock outcrops on shady slopes, flowers in mid-summer.

[6] Differs from ssp. *arborescens*: Taller shrubs to 2 m, **L**-bearing **Br** 4 mm $\varnothing$; **L** 2.5 - 4 $\times$ 1.2 - 2 cm, lanceolate, ovate to obovate, less succulent, with soft texture, surface with inconspicuous hydathodes, margins reddish with few undulations.

C. atropurpurea (Haworth) D. Dietrich (Synops. Pl. 2: 1031, 1840). **T:** K [lecto: unpubl. t. 780]. – **D:** Namibia, RSA.

$\equiv$ *Globulea atropurpurea* Haworth (1824).

C. atropurpurea var. **anomala** (Schönland & Baker fil.) Tölken (JSAB 41: 96, 1975). **T:** RSA, Western Cape (*Schlechter* 9317 [GRA, BM, BOL, E, G, K, LE, P, Z]). – **D:** RSA (Western Cape); Fynbos and Succulent Karoo, flowers mid-summer.

$\equiv$ *Crassula anomala* Schönland & Baker fil. (1898) $\equiv$ *Globulea atropurpurea* var. *anomala* (Schönland & Baker fil.) P. V. Heath (1995).

[20] Differs from var. *atropurpurea*: **Br** decumbent, to 10 mm $\varnothing$, all parts covered with erect **Ha**; **L** reddish, linear to broadly obovate, tips obtuse; lower 1 - 2 pairs of **Bra** of the **Inf** without dichasia; dichasia with densely clustered **Fl**; **Pet** tips with canaliculate dorsal beak-like appendage.

C. atropurpurea var. **atropurpurea** – **D:** RSA (Western Cape, Eastern Cape); Succulent Karoo, thickets, flowers in spring and summer.

Incl. *Crassula obliqua* Haworth (1821) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula clavifolia* Harvey (1862); **incl.** *Crassula micrantha* Schönland (1910); **incl.** *Crassula smutsii* Schönland (1929) $\equiv$ *Globulea atropurpurea* var. *smutsii* (Schönland) P. V. Heath (1995).

[20] Much-branched erect to decumbent shrublets with woody basal **Br**; younger **Br** green to purplish, pubescent; **L** spreading (young ascending), obovate to oblanceolate, glabrous, flattened, 10 - 25 $\times$ 5 - 13 mm, tip obtuse, base cuneate, lower face convex, margins horny; older **L** deciduous; **Inf** erect elongated thyrses with several glomerate dichasia at the 3 - 5 nodes of the peduncle; peduncle to 20 cm; **Sep** triangular-lanceolate, to 3 mm, margin ciliate; **Cl** tubular; **Pet** fused at the base, cream or white, panduriform, 2 - 4.5 mm, tip beaked.

C. clavifolia var. *marginata* Schönland is perhaps the hybrid *C. atropurpurea* var. *atropurpurea* $\times$ *C. atropurpurea* var. *rubella* (Tölken 1985: 221).

C. atropurpurea var. **cultriformis** (H.-C. Fried-

rich) Tölken (JSAB 41: 96, 1975). **T:** RSA, Northern Cape (*Herre* 4088 [M]). – **D:** S Namibia, N RSA (Northern Cape); Succulent Karoo, flowers spring to early summer. **I:** Tölken (1985: 217, fig. 21: 4).

≡ *Crassula cultriformis* H.-C. Friedrich (1967); **incl.** *Crassula cultriformis* ssp. *robusta* H.-C. Friedrich (1967); **incl.** *Crassula cinerea* H.-C. Friedrich (1974).

[20] Differs from var. *atropurpurea*: **Br** decumbent, to 6 mm Ø; **L** linear-oblongate, green to reddish; lower 2 pairs of **Bra** of the **Inf** usually without dichasia; peduncle with recurved **Ha**.

C. atropurpurea var. **purcellii** (Schönland) Tölken (JSAB 41: 96, 1975). **T:** RSA, Western Cape (*Purcell* s.n. [GRA]). – **D:** RSA (Western Cape); Succulent Karoo and Dry Fynbos, flowers spring to mid-summer.

≡ *Crassula purcellii* Schönland (1907) ≡ *Globulea atropurpurea* var. *purcellii* (Schönland) P. V. Heath (1995).

[20] Differs from var. *atropurpurea*: **Br** erect, woody, to 12 mm Ø; **L** linear-elliptic, grey, covered with appressed **Ha**.

C. atropurpurea var. **rubella** (Compton) Tölken (JSAB 41: 96, 1975). **T** [syn]: RSA, Western Cape (*Compton* 2820 [BOL]). – **D:** RSA (Western Cape); Succulent Karoo, flowers mid-summer.

≡ *Crassula rubella* Compton (1931) ≡ *Globulea atropurpurea* var. *rubella* (Compton) P. V. Heath (1995) (*nom. inval.*, Art. 34.1a,c); **incl.** *Crassula clavifolia* var. *muirii* Schönland (1929) ≡ *Crassula atropurpurea* var. *muirii* (Schönland) G. D. Rowley (1978) ≡ *Globulea atropurpurea* var. *muirii* (Schönland) P. V. Heath (1995).

[20] Differs from var. *atropurpurea*: **Br** erect, wiry, to 4 mm Ø, all parts covered with appressed **Ha**; **L** narrowly to broadly obovate, green to reddish, tips obtuse; **Fl** in dense dichasia; **Pet** tips acute, canaliculate.

C. atropurpurea var. **watermeyerii** (Compton) Tölken (JSAB 41: 96, 1975). **T:** RSA, Northern Cape (*Compton* 3208 [BOL]). – **D:** RSA (Northern Cape). **Fig. V.b**

≡ *Crassula watermeyerii* Compton (1931) ≡ *Globulea atropurpurea* var. *watermeyerii* (Compton) P. V. Heath (1995); **incl.** *Crassula gifbergensis* H.-C. Friedrich (1974) ≡ *Globulea atropurpurea* var. *gifbergensis* (H.-C. Friedrich) P. V. Heath (1995).

[20] Differs from var. *atropurpurea*: **L** larger, broadly obovate, green to yellowish-green, tips obtuse, covered with erect **Ha**; **Inf** of lax spreading dichasia; **Pet** tips with channelled sharp point.

C. serpentaria Schönland appears to be a hybrid between this taxon and *C. tomentosa* var. *tomentosa* (Tölken 1985: 222).

C. aurisbergensis G. Williamson (CSJA 64(6): 288-289, ills., 1992). **T:** Namibia (*Williamson* 4416 [BOL, NBG]). – **D:** S Namibia.

[17] Dwarf and compactly branched forming rounded tufts to 9.5 cm Ø; **R** fibrous; **Br** short; **Int** short and hidden; **L** rosulate, 10 - 25 × 7 - 14 mm, ascending-spreading, oblanceolate to oblong-oblongate, persistent when old, flattened, glabrous, grey-green, upper face flat to slightly convex with an off-centre groove, lower face convex, margin ciliate, tip acute to rounded; **Inf** rounded thyrses with few globose dichasia; peduncle to 2.5 cm; **Sep** narrowly triangular, papillate, to 3 mm, obtuse; **Cl** to 3 mm, cup-shaped, lobes fused at the base, white, obtuse, tips without dorsal appendage; **Anth** yellow.

C. ausensis Hutchison (CSJA 24(4): 106-108, ills., 1952). **T:** Namibia (*Dinter* 3584 [BOL, UC [fragment]]). – **D:** Namibia.

C. ausensis ssp. **ausensis** – **D:** S Namibia; Succulent Karoo, Nama Karoo, quartz and granite gravel flats, autumn-flowering. **I:** Tölken (1985: 203, fig. 19: 3, 3a). **Fig. V.a**

Incl. *Crassula ausiensis* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Crassula hofmeyeriana* Dinter (1923) (*nom. inval.*, Art. 32.1c); **incl.** *Crassula karasana* H.-C. Friedrich (1960); **incl.** *Crassula littlewoodii* H.-C. Friedrich (1967).

[17] Dwarf, much branched, forming spreading tufts with **L** in basal **Ros**; **R** fibrous; **Br** short, axis to 3 mm Ø; **L** 15 - 35 × 6 - 11 mm, oblanceolate to elliptic, old persistent, lamina flattish, epidermis with short spreading **Ha**, grey-green, reddish at tips and margins, upper face flat to slightly convex, lower face convex, tip acute, mucronate; **Inf** elongated thyrses with several globose dichasia or a solitary subumbellate dichasium; peduncle to 8 cm; **Sep** triangular, to 3 mm, margins ciliate, tips acute; **Cl** to 6 mm, tubular, lobes fused at the base, white to cream, tips with indistinct dorsal appendage; **Anth** brown.

C. ausensis ssp. **giessii** (H.-C. Friedrich) Tölken (JSAB 41: 96, 1975). **T:** Namibia (*Merxmiller & Giess* 28956 [M]). – **D:** S Namibia; Namib Desert, shallow rock pockets and rock crevices.

≡ *Crassula giessii* H.-C. Friedrich (1974).

[17] Differs from ssp. *ausensis*: **L** obovate, sparingly pubescent, with long marginal ciliae; **Inf** solitary dichasia with up to 5 sessile **Fl**.

C. ausensis ssp. **titanopsis** Pavelka (Kaktusy 34(2): 39-43, ills., 1998). **T:** Namibia (*Pavelka* 954 [PRC]). – **D:** S Namibia; rock crevices in the Namib Desert.

[17] Differs from ssp. *ausensis*: Smaller in stature; **L** ovate to obovate, with very fine regular white papillae (1 × 1 mm), without long marginal cilia.

C. badspoortensis van Jaarsveld (Aloe 38(1-2): 29-30, ills., 2001). **T:** RSA, Western Cape (*van Jaarsveld* 16111 [NBG]). – **D:** RSA (Western Cape: Little Karoo); quartzitic sandstone cliffs, summer- and autumn-flowering.

[15] Sparsely branched (3 - 8 **Br**) shrublets to 10 cm tall and 40 cm Ø; stems 3 - 4 mm Ø, spreading and becoming pendulous, **Int** 6 - 10 mm; **L** sessile, broadly ovate, 20 - 35 mm long and broad, flat to slightly biconvex, spreading at right angles but slightly ascending and curved forwards, basally fused and amplexicaul, surface smooth, glaucous to whitish-green, margins entire, tip subacute; **Inf** short rounded thyrses to 4 cm tall and 6.5 cm Ø; **Fl** numerous, in dichasia, 5-merous; **Ped** 2 - 5 mm; **Sep** triangular, 1.3 × 0.8 mm, tips acute; **Cl** stellate, white, lobes 3.5 × 1 mm, lorate-lanceolate, recurved, tips obtuse to subacute; **Anth** dark maroon; **NSc** truncate, 0.3 × 0.2 mm, thick and fleshy, yellowish-orange.

C. barbata Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 329, 332, 1778). **T:** RSA, Western Cape (*Thunberg* 7731 [UPS, G-DC, STB]). – **D:** RSA.

≡ *Purgosea barbata* (Thunberg) G. Don (1834).

C. barbata ssp. **barbata** – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo, Nama Karoo, flowers spring and early summer.

Incl. *Crassula letyae* E. Phillips (1931).

[14] Monocarpic, usually solitary **Ros**, or proliferating from the base to form small groups to 3 cm tall (excl. **Inf**); **R** fibrous; **L** decussate, in dense basal **Ros**, glabrous but margin with dense long white ascending-spreading cilia to 5 mm, older **L** to 25 × 40 mm, obtriangular to almost circular, tip truncate, inner (younger) **L** obovate, to 15 × 12 mm, tip acute; **Inf** terminal spike-like thyrses 16 - 30 cm tall; peduncle 6 cm × 5 mm with 5 pairs of decussate **Bra** becoming smaller upwards, lower ovate lanceolate, 12 × 8 mm, upper 5 × 4 mm, all with cilia on the margins; **Fl** spreading, to 7 in decussate sessile glomerate dichasia 7 × 8 mm, sweetly scented; **Sep** 1.3 - 3 mm, triangular-ovate; **Cl** tubular; **Pet** oblong, 5 - 6 mm, fused in the lower part, white, flushed with pink, becoming recurved; **Ca** conical.

C. barbata ssp. **broomii** (Schönland) Tölken (JSAB 41: 97, 1975). **T:** RSA, Northern Cape (*Broom* s.n. [GRA]). – **D:** RSA (Northern Cape); Nama Karoo, flowers spring and early summer.

≡ *Crassula broomii* Schönland (1907).

[14] Differs from ssp. *barbata*: **L** broadly obovate, 30 - 40 × 10 - 35 mm, marginal cilia shorter, < 1 mm; **Pet** ascending; **Ca** elongate-reniform.

C. barklyi N. E. Brown (BMI 1906: 19, 1906). **T:** RSA, Northern Cape (*Barkly* s.n. [K]). – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo,

quartz gravel flats, flowers from mid-winter to spring. **I:** Tölken (1985: 194, fig. 18:1).

≡ *Tetraphyle barklyi* (N. E. Brown) P. V. Heath (1993); **incl.** *Crassula teres* Marloth (1913).

[16] Dwarf, compact, procumbent to decumbent, sparingly to densely branched from the base and forming clusters to 3.5 - 9 cm Ø; **R** fibrous; **Br** completely covered by the densely tightly clasping and imbricate **L** forming a neat smooth quadrangular oblong **Bo** 6 - 12 mm Ø, tapering at the obtuse apex; **L** green to brownish-green, transversely depressed, 3 - 5 × 5 - 10 mm, very broadly ovate, patelliform, margin white, membranous, minutely ciliate, tip obtuse; **Inf** dense terminal rounded cymose capitula 5 mm tall and to 7 mm Ø, basal part hidden by the **L**; **Sep** to 5 mm, oblong-ob lanceolate, margin ciliate, tip obtuse; **Cl** tubular, ampulliform, to 14 mm, cream, lobes oblong-lorate, fused in the lower 1/3, tips obtuse; **Anth** yellow.

C. basaltica Brullo & Siracusa (Fl. Medit. 4: 175-178, ills., 1994). **T:** Italy, Sicilia (*Brullo & Siracusa* s.n. [CAT]). – **D:** Italy (Sicily: W slopes of Mt. Etna); basaltic lava, ± 800 m.

[2] Dwarf glabrous annual herbs to 4 cm, erect or ascending, simple or basally branched with 1 - 2 (-4) **Br**; **Int** 0.5 - 3 mm; **L** 1 - 5 × 2 mm, glaucous green, basally 0.1 - 0.2 mm connate, subspatulate-lanceolate, papillose-verrucose, tip acute or rarely apiculate; **Fl** 5-merous, 2 - 3 in the **L** axils, sessile or almost so; **Cal** urceolate; **Sep** 2 × 0.8 mm, mucronate, tip green and papillate; **Pet** lanceolate, mucronate, purplish-red, 1.2 mm; **Se** 2 per **Ca**, elliptic, glabrous, brown, 0.25 mm.

Despite the overall similarity to *C. tillaea*, this species appears taxonomically quite isolated. – [U. Eggli]

C. bergioides Harvey (FC 2: 352, 1862). **T:** RSA, Western Cape (*Zeyher* 2575 [S, FI, LE?, SAM]). – **D:** RSA (Western Cape); mainly in Renosterveld and Fynbos, spring-flowering.

Incl. *Crassula aristata* Schönland (1909); **incl.** *Crassula pusilla* Schönland (1913).

[2] Erect glabrous annuals; **R** fibrous; stems to 6 cm tall, sparingly branching with short lateral **Br**; **L** 4 - 12 × 2 - 4 mm, sessile, linear-triangular to lanceolate, glabrous, green to brown-green, margin horny, papillose, tip acute with a terminal stout **Ha**; **Inf** erect thyrses with numerous sessile dichasia; **Fl** pedicellate, 5-merous; **Cal** lobes to 3 mm, triangular, tip acute with a terminal stout **Ha**; **Cl** cup-shaped to tubular, white, lobes triangular-lanceolate, acute, keeled; **Anth** yellow.

C. biplanata Haworth (Philos. Mag. J. 64: 186, 1824). **T:** K [lecto: unpubl. t. 771]. – **D:** RSA (Western Cape, Eastern Cape); mainly on rocks in shallow soil.

≡ *Creusa biplanata* (Haworth) P. V. Heath

(1993); **incl.** *Crassula punctulata* Schönland & Baker (1898) $\equiv$ *Creusa biplanata* var. *punctulata* (Schönland & Baker) P. V. Heath (1993).

[9] Decumbent to erect moderately branched glabrous herbs to ± 20 cm tall in small groups; **Br** 1 mm $\varnothing$, green to reddish-green, covered with short papillae; older **Br** smooth, with brown bark, sometimes with aerial **R**; main stem somewhat swollen; **L** ascending, 4 - 15 $\times$ 1.5 - 3 mm, green, covered with white bloom, lanceolate to linear-lanceolate, flattened to terete, margin revolute under dry conditions, tips acute; older **L** deciduous; **Inf** flat-topped dichasia with numerous densely arranged **Fl**; peduncle to 18 cm with up to 2 pairs of **Bra**; **Sep** to 2 mm; **Cl** white to cream, tubular, to 6 mm, lobes bluntly acute with dorsal ridges; **Anth** brown.

C. brachystachya Tölken (JSAB 41: 97-98, 1975). **T**: RSA, Western Cape (*Compton* 2819 [BOL]). – **D**: RSA (Western Cape: Witteberg, N Swartberg); quartzitic sandstones, moist shaded crevices, flowers in mid-summer.

[14] Small spreading decumbent branched perennials to 20 cm tall (**incl.** **Inf**); **R** tuberous; **L** in a **Ros**, opposite and spiralled, 2 - 8 $\times$ 0.5 - 2 cm, oblanceolate-oblong, flattened, green, tinged red along the sparingly ciliate margin, slightly biconvex, glabrous, base cuneate, tip obtuse to acute; **Inf** erect terminal spike-like thyrses with 1 to many dichasia; **Bra** L-like but shorter; **Fl** sessile or shortly pedicellate; **Sep** to 4.5 mm, oblong-elliptic, glabrous, tip with a short recurved **Ha**, margin ciliate; **Cl** tubular, cream to white, to 6 mm; **Pet** oblong-ovate, to 5 mm, fused shortly at base, tip acute, recurved; **Anth** black; **Ca** with 12 - 26 ovules.

C. brevifolia Harvey (FC 2: 339, 1862). **T**: RSA, Northern Cape (*Zeyher* 661 [S, BM, E, FL, K, LE, P, SAM, UPS, Z]). – **D**: Namibia, RSA.

C. brevifolia ssp. *brevifolia* – **D**: S Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, among rocks, autumn-flowering. **Fig. V.c**

Incl. *Crassula pearsonii* Schönland (1912) (*nom. illeg.*, Art. 52.1); **incl.** *Crassula montis-draconis* Dinter (1923); **incl.** *Crassula flavovirens* Pillans (1930); **incl.** *Crassula fragillima* Dinter (1931) (*nom. inval.*, Art. 32.1c).

[15] Branched rounded shrublets to 50 cm tall; **R** fibrous; **Br** green, round, 6 mm $\varnothing$, older **Br** woody, reddish-brown; **L** 10 - 40 $\times$ 5 - 18 mm, curving upwards, variable in shape, elliptic to linear-elliptic, flattened, green turning purplish or yellowish-green with powdery bloom, glabrous, upper face flat to convex, lower face convex to cymbiform, tip acute; **Inf** terminal rounded thyrses; peduncle to 4 cm; **Sep** triangular, 1.5 mm; **Cl** tubular, white to reddish tinged, lobes fused at the base, to 5 mm, oblong-elliptic; **Anth** black or yellow.

C. brevifolia ssp. *psammophila* Tölken (JSAB 41: 98-99, 1975). **T**: RSA, Northern Cape (*Tölken* 4004 [BOL]). – **D**: RSA (Northern Cape); Succulent Karoo, among rocks, flowers autumn to mid-winter.

$\equiv$ *Crassula psammophila* Hort. München (s.a.) (*nom. inval.*, Art. 29.1).

[15] Differs from ssp. *brevifolia*: Upper **Br** thinner, 3 - 4 mm $\varnothing$; **L** spreading, greenish, without bloom; **Inf** flat-topped thyrses, peduncle to 8 cm; **Cl** yellowish green.

C. campestris (Ecklon & Zeyher) Endlicher *ex* Walpers (Repert. Bot. Syst. 2: 253, 1843). **T**: RSA, Cape Prov. (*Ecklon & Zeyher* 1873 [FL, G, K, LE, S, SAM, TCD]). – **D**: Namibia, RSA (Northern Cape, Western Cape, Free State), Spain, Italy (Sicily); rock outcrops in Succulent Karoo and Nama Karoo, flowers in spring and early summer.

$\equiv$ *Tetraphyle campestris* Ecklon & Zeyher (1837) $\equiv$ *Sedum campestre* (Ecklon & Zeyher) Kuntze (1898) $\equiv$ *Combesia campestris* (Ecklon & Zeyher) P. V. Heath (1993); **incl.** *Crassula campestris* fa. *compacta* Schönland (1917); **incl.** *Crassula campestris* fa. *laxa* Schönland (1917); **incl.** *Crassula pentandra* ssp. *catalaunica* Vigo & Terradas (1969).

[2] Erect to decumbent glabrous annuals; **R** fibrous; stems to 10 cm, sparingly branching with short lateral **Br**; **L** 4 - 10 $\times$ 1 - 3 mm, sessile, lanceolate to linear-triangular, glabrous, green to brown-green, lower face convex, margin entire, rarely denticulate at the base, tip subacute; **Inf** erect thyrses with numerous subsessile dichasia; **Fl** pedicellate (**Ped** elongating in **Fr**), 5-merous; **Cal** lobes to 1.5 mm, linear-triangular to lanceolate, tip acute with a terminal awn; **Cl** cup-shaped, pale yellow, lobes to 0.8 mm, triangular-lanceolate, tips acute, cucullate; **Anth** yellow.

Recently discovered in Sicily (Brullo & al. 1998). The status of its occurrence in Europe (native vs. introduced) is unresolved (Jalas & al. 1999: 46).

C. capensis (Linné) Baillon (Hist. Pl. 3: 311, 1874). **T**: RSA, Western Cape (*Van Rooyen* s.n. [LINN 480.2]). – **D**: RSA.

$\equiv$ *Septas capensis* Linné (1760).

C. capensis var. *albertiniae* (Schönland) Tölken (JSAB 41: 99, 1975). **T**: RSA, Western Cape (*Muir* 1315 [GRA]). – **D**: RSA (Western Cape); usually exposed on flats and slopes, flowers autumn to mid-winter.

$\equiv$ *Crassula albertiniae* Schönland (1917) $\equiv$ *Septas capensis* var. *albertiniae* (Schönland) P. V. Heath (1993); **incl.** *Crassula bartlettii* Schönland (1929).

[7] Differs from var. *capensis*: **L** developing only after flowering and at ground-level, petioles to 1 cm, lamina elliptic to oblanceolate, margin entire,

slightly undulate when young; **Inf** with peduncle to 15 cm.

C. capensis var. **capensis** – **D**: RSA (Western Cape); flats and slopes, usually exposed, flowers autumn to early summer. **I**: Tölken (1985: 140, fig. 15: 3).

Incl. *Crassula septas* Thunberg (1794) (*nom. illeg.*, Art. 52.1 ?); **incl.** *Septas globifera* Sims (1812) $\equiv$ *Crassula globifera* (Sims) Sprengel (1825); **incl.** *Septas globiflora* Haworth (1819) (*nom. inval.*, Art. 61.1); **incl.** *Crassula septas* var. *leipoldtii* Schönland (1929) (*incorrect name*, Art. 11.3).

[7] Geophytes with erect branched stems to 20 cm; rhizome branched, with several globose tubers with fibrous adventitious **R**; **L** in 2 - 4 pairs, 1 - 8 $\times$ 0.5 - 6 cm, developing before or during flowering, flattened, obovate to elliptic, basal **L** with petioles to 2 cm, margins crenate to doubly crenate, surface glabrous, green, rarely purplish below, base cuneate to cordate, tip obtuse to subacute; **Inf** terminal umbellate thyrse; peduncle to 12 cm; **Sep** triangular-lanceolate, to 3 mm; **Cl** 5- to 12 merous, stellate, to 2 cm $\varnothing$, white, or tinged pink, lobes lanceolate, to 8 mm, tip acute, spreading; **Anth** brown.

C. capensis var. **promontorii** (Schönland & Baker *fil.*) Tölken (JSAB 41: 99, 1975). **T**: RSA, Western Cape (Wolley-Dod 1624 [GRA, SAM]). – **D**: RSA (Western Cape); usually in the shade, flowers spring to early summer.

$\equiv$ *Crassula promontorii* Schönland & Baker *fil.* (1898) $\equiv$ *Septas capensis* var. *promontorii* (Schönland & Baker *fil.*) P. V. Heath (1993).

[7] Differs from var. *capensis*: Stems often branched; **L** developing before flowering and 2 - 5 cm above ground-level, petioles to 4 cm, lamina obovate to ovate, margin crenate to entire; **Inf** subumbellate thyrse.

C. capitella Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 330, 339, 1778). **T**: RSA, Western Cape (Thunberg 7732a [UPS]). – **D**: Tropical E Africa to Namibia and RSA.

$\equiv$ *Purgosea capitella* (Thunberg) Sweet (1830).

C. capitella ssp. **capitella** – **D**: RSA (Free State, Northern Cape, Western Cape, Eastern Cape); Nama and Succulent Karoo, dry slopes, flowers mid-summer to autumn.

Incl. *Crassula spicata* Thunberg (1778) $\equiv$ *Purgosea spicata* (Thunberg) G. Don (1834); **incl.** *Globulea impressa* Haworth (1824) $\equiv$ *Crassula impressa* (Haworth) D. Dietrich (1840); **incl.** *Globulea impressa* var. *minor* Haworth (1824); **incl.** *Globulea paniculata* Haworth (1825) $\equiv$ *Crassula paniculata* (Haworth) D. Dietrich (1840); **incl.** *Crassula capitellata* De Candolle (1828) (*nom. inval.*, Art. 61.1); **incl.** *Crassula turrita* var. *latifolia* Harvey (1862);

incl. *Crassula albanensis* Schönland (1903); **incl.** *Crassula rufo-punctata* Schönland (1913); **incl.** *Crassula hemisphaerica* var. *recurva* Schönland (1929); **incl.** *Crassula subbifaria* Schönland (1929).

[14] Small erect usually solitary rosulate perennials (rarely biennials); **R** fibrous; **Br** almost glabrous, sometimes with few spreading **Ha**; **L** 1.5 - 10 $\times$ 0.5 - 3.5 cm, linear-lanceolate to elliptic to obovate, flattened, glabrous, margin ciliate, upper face flat to slightly convex, lower face convex, tip acute; **Inf** erect terminal spike-like thyrse with many sessile dichasia; **Bra** **L**-like becoming shorter upwards; **Sep** to 2 mm, lanceolate to triangular, glabrous, tip acute, margin ciliate; **Cl** tubular, cream to white, to 4 mm; **Pet** oblong, to 5 mm, fused shortly at the base, tips with a rounded dorsal appendage; **Anth** black to brown.

C. capitella ssp. **meyeri** (Harvey) Tölken (JSAB 41: 100, 1975). **T**: RSA, KwaZulu-Natal (*Drège* s.n. [S, G, P]). – **D**: RSA (C KwaZulu-Natal); coastal dunes, winter-flowering.

$\equiv$ *Crassula meyeri* Harvey (1862); **incl.** *Crassula brevistyla* Baker *fil.* (1903); **incl.** *Crassula natalensis* var. *mossii* Schönland (1929).

[14] Differs from ssp. *capitella*: Rosulate forming clusters; **Br** robust, decumbent, basally woody, glabrous or with scattered **Ha**; **L** 2 - 5 $\times$ 0.5 - 1.5 cm, oblong-elliptic, glabrous, margin ciliate, tip obtuse to rounded; **Inf** spike-like thyrse with flat-topped dichasia; **Sep** to 2.5 mm; **Pet** oblong, with a denticulate apical appendage.

C. capitella ssp. **nodulosa** (Schönland) Tölken (JSAB 41: 100, 1975). **T**: RSA, North-West Prov. (Adams 28 [GRA, SAM]). – **D**: Tropical E Africa (Uganda, Kenya, Tanzania), Namibia, Botswana, RSA (Free State, Northern Cape, North-West Prov., Gauteng, Mpumalanga); grassland on dry rocky slopes, flowers mid-summer to autumn.

$\equiv$ *Crassula nodulosa* Schönland (1903); **incl.** *Crassula enantiophylla* Baker *fil.* (1903) $\equiv$ *Crassula capitella* ssp. *enantiophylla* (Baker *fil.*) Tölken (1975); **incl.** *Crassula elata* N. E. Brown (1909); **incl.** *Crassula pectinata* Conrath (1914); **incl.** *Crassula avasimontana* Dinter (1923); **incl.** *Crassula guchabensis* Merxmüller (1951); **incl.** *Crassula nodulosa* fa. *rhodesica* R. Fernandes (1978); **incl.** *Crassula nodulosa* var. *longisepala* R. Fernandes (1978).

[14] Differs from ssp. *capitella*: Basally tuberous, with 1 to few **Ros**; **Br** erect with short **Ha**; **L** 1 - 6 $\times$ 1 - 3.5 cm, obovate, covered with short **Ha**, margin ciliate, tip acute; **Inf** unbranched; **Bra** with short **Ha**; **Sep** to 3 mm; **Pet** oblong, tips with rounded apical appendage.

C. capitella ssp. **sessilicymula** (Mogg) Tölken (Fl. South Afr. 14: 184, 1985). **T**: RSA, Gauteng (*Mogg* 12503 [PRE]). – **D**: RSA (N Gauteng, Nor-

thern Prov.); *Acacia* savanna, flowers mid-summer to autumn.

≡ *Crassula sessilicymula* Mogg (1937).

[14] Differs from ssp. *capitella*: Basally woody (not tuberous); **L** 2 - 5 × 0.8 - 2 cm, lanceolate, finely papillate, later glabrescent, margin ciliate, tip acute to obtuse; **Inf** branched from the base; **Sep** to 2.5 mm; **Pet** oblong with a denticulate dorsal appendage.

C. capitella ssp. *thyrsiflora* (Thunberg) Tölken (JSAB 41: 100, 1975). **T**: RSA, Eastern Cape (Thunberg 7801 [UPS]). – **D**: S Namibia, RSA (Northern Prov., Free State, Western Cape, Eastern Cape); Succulent Karro and Nama Karro, dry rocky slopes, flowers mid-summer to autumn. **Fig. V.d**

≡ *Crassula thyrsiflora* Thunberg (1778) ≡ *Purgosea thyrsiflora* (Thunberg) Sweet (1830); **incl.** *Crassula turrita* Thunberg (1778) ≡ *Purgosea turrita* (Thunberg) Sweet (1830); **incl.** *Aloe pertusa* Haworth (1804) ≡ *Purgosea pertusa* (Haworth) Haworth (1821); **incl.** *Crassula turrita* var. *rosea* Haworth (1819); **incl.** *Crassula corymbulosa* Link & Otto (1820) ≡ *Purgosea corymbulosa* (Link & Otto) Sweet (1830) ≡ *Sedum corymbulosum* (Link & Otto) Kuntze (1898); **incl.** *Purgosea pertusula* Haworth (1828); **incl.** *Purgosea turrita* var. *alba* Sweet (1830); **incl.** *Crassula corymbulosa* var. *typica* Schönland (1904) (*nom. inval.*, Art. 24.3); **incl.** *Crassula corymbulosa* var. *cordata* Schönland (1914); **incl.** *Crassula corymbulosa* var. *lanceolata* Schönland (1914); **incl.** *Crassula corymbulosa* var. *major* Schönland (1914); **incl.** *Crassula nuda* Compton (1932); **incl.** *Crassula triebneri* Schönland ex H. Jacobsen (1954) (*nom. inval.*, Art. 36.1); **incl.** *Crassula rhodogyna* H.-C. Friedrich (1960).

[14] Differs from ssp. *capitella*: Prolific much-branched and mat-forming; **L** rosulate, often 4-ranked, 1.5 - 8 × 0.5 - 1.8 cm, flattened, glabrous, green to bright purplish-red (dry exposed places), upper face slightly convex, flat to concave, lower face convex, margin entire to ciliate, tip acute; **Inf** unbranched to branched with pedunculate dichasia; **Sep** to 2.5 mm; **Pet** oblong-obovate, with a rounded dorsal appendage.

C. ciliata Linné (Spec. Pl. [ed. 1], 283, 1753). **T**: [lecto – icono]: Dillenius, Hort. Eltham. t. 98, f. 116, 1732. – **D**: RSA (Western Cape, Eastern Cape); Renosterveld, rocky regions and flats, flowers mid-summer; naturalized in S Australia. **Fig. V.e**

≡ *Purgosea ciliata* (Linné) Sweet (1830) ≡ *Sedum ciliatum* (Linné) Kuntze (1898) ≡ *Sphaeritis ciliata* (Linné) P. V. Heath (1993).

[11] Moderately branched decumbent rounded succulent subshrubs to 30 cm tall; **Br** green, to 7 mm Ø, glabrous with persistent older **L**; **L** flat above, flat to convex below, 15 - 30 × 10 - 13 mm, loriate to loriate-oblancheolate, glabrous, margin ac-

ute, ciliate, tips obtuse; **Inf** erect rounded thyrses 2 cm tall and to 4.5 cm Ø, with several dichasia; peduncle to 20 cm tall with a gradual transition from **L** to **Bra**; **Ped** short, sometimes to 5 mm; **Sep** 3 mm, linear-lanceolate; closed buds to 5 mm; **Cl** white to pale yellow, tubular below, stellate above, to 4 mm Ø; **Pet** spreading, becoming recurved, linear-lanceolate to panduriform, to 4.5 mm; **Anth** orange-brown to yellow.

C. clavata N. E. Brown (BMI 1914: 167, 1914). **T**: RSA, Western Cape (Pearson s.n. [KJ]). – **D**: RSA (Northern Cape, Western Cape); Succulent Karoo, gravel flats and mountains, flowers in spring.

≡ *Globulea clavata* (N. E. Brown) P. V. Heath (1995).

[20] Acaulescent solitary or hardly offsetting perennials (to ± 3 **Br** in tufts), to 5 cm tall (excl. **Inf**); **R** fibrous; **L** rosulate, spreading to ascending, deep red, 15 - 40 × 7 - 11 mm, linear-lanceolate, oblanceolate to obovate, flattened, biconvex, glabrous, rarely with stout marginal cilia; **Inf** terminal ascending thyrses to 28 cm with several glomerate dichasia; peduncle to 21 cm; dichasia globose, to 12 mm Ø; **Sep** 2.3 mm, loriate-lanceolate, ciliate, obtuse; **Cl** tubular, white to cream; **Pet** fused basally, to 3.5 mm, tips with globose apical swelling.

C. closiana (Gay) Reiche (Fl. Chile 2: 369, 1897). **T**: Chile, Región Metropolitana (Gay s.n. [P]). – **D**: Mexico, Peru, Bolivia, Chile, Australia (incl. Tasmania); damp places. **I**: Bywater & Wickens (1984: 720, fig. 5: F-L). **Fig. V.f**

≡ *Tillaea closiana* Gay (1847); **incl.** *Tillaea macrantha* var. *pedicellosa* F. Mueller (1881) ≡ *Tillaea pedicellosa* (F. Mueller) F. Mueller (1889) ≡ *Crassula pedicellosa* (F. Mueller) Ostenfeld (1918); **incl.** *Tillaeastrum latifolium* Rose (1911) ≡ *Tillaea latifolia* (Rose) Calderón (1974); **incl.** *Crassula macbridei* Steyermark (1938).

[2] Erect herbs 2 - 4.5 cm tall, simple or sparingly branched from the middle; **L** oblanceolate to obovate, 2 - 9 × 1 - 2.5 mm, ± acute, margins slightly ciliate; **Fl** 1 - 2 per node; **Ped** (1-) 6 - 8 (-11) mm; **Sep** lanceolate, 1.4 - 2.4 × 0.2 - 0.5 mm, papillate on the dorsal midrib; **Pet** ovate, 1.1 - 1.3 × 0.5 - 0.7 mm, slightly cucullate; **NSc** oblong, 0.4 × 0.2 mm; **Se** small, oblong, ± 0.27 - 0.32 × 0.15 - 0.19 mm, reddish-brown, papillate and minutely rugulose.

C. pedicellosa is here included on the base of Bywater & Wickens (1984: 722). – [U. Eggli]

C. coccinea Linné (Spec. Pl. [ed. 1], 282, 1753). **T**: BM. – **D**: RSA (Western Cape); mountainous Fynbos, acid soil on quartzitic sandstone, flowers mid-summer. **Fig. V.g**

≡ *Rochea coccinea* (Linné) De Candolle (1802) ≡ *Larochea coccinea* (Linné) Persoon (1805) ≡ *Dietrichia coccinea* (Linné) Trattinnick (1812) ≡ *Kalosanthes coccinea* (Linné) Haworth (1821); **incl.**

Crassula versicolor Burchell ex Ker Gawler (1818) $\equiv$ *Kalosanthus versicolor* (Burchell ex Ker Gawler) Haworth (1821) $\equiv$ *Rochea versicolor* (Burchell ex Ker Gawler) Link (1821) $\equiv$ *Dietrichia versicolor* (Burchell ex Ker Gawler) Ecklon & Zeyher (1837); **incl.** *Kalosanthus coccinea* var. *alba* Haworth (1821).

[13] Sparingly branched erect to spreading perennials with leafy stems to 60 cm tall; **R** fibrous; **Br** green, succulent, 7 mm $\varnothing$, covered with decurrent **L**-pairs; **Int** not visible; **L** ascending-spreading, 20 - 35 $\times$ 8 - 15 mm, flattish, ovate-lanceolate, 4-ranked, glabrous, upper face flat to channelled, lower face flat to slightly convex, margin ciliate, tip acute; **Inf** cymose-capitate thyrses to 10 cm $\varnothing$ with 1 to several dichasia with sessile **Fl**; **Sep** linear-lanceolate, to 22 mm, fused in the lower $\frac{1}{2}$, margin ciliate, tip acute; **Cl** tubular, to 45 $\times$ 3 mm $\varnothing$ at the narrowest place, 6 mm $\varnothing$ **incl.** limb, scarlet, rarely white; **Pet** fused for up to 7 mm at the base, linear-spatulate, tips spreading becoming recoiled; **St** to 25 mm; **Anth** dull yellow.

C. colorata (Nees) Ostenfeld (Dansk. Bot. Ark. 2(8): 45-46, ill., 1918). **T:** Australia, Western Australia (*Preiss* 1932 [LD, LE, MEL, S]). - **D:** S Australia; widespread.

$\equiv$ *Tillaea colorata* Nees (1844).

[2] Annuals with erect stems to 15 cm, little-branched mainly from the base; **L** lanceolate, 2 - 4 (-6) $\times$ 1.5 - 3 (-4) mm, obtuse (rarely acute), slightly but abruptly constricted at the base, flat, upper face flat or slightly convex, lower face $\pm$ convex, green to reddish-brown; **Inf** 1 (sometimes several) thyrsoids (rarely panicles) with sessile dichasia in the **Ax** of the **L**-like **Bra**; **Fl** 5-merous; **Ped** absent or rarely to 1 mm; **Sep** triangular to lanceolate, 1 - 2.5 mm; **Cl** cup-shaped, pale yellow to red; **Pet** lanceolate, 1 - 2 mm; **NSc** linear; **Se** 2 per **Ca**, usually faintly ridged.

A widespread complex of varieties based predominantly on characters of the carpels. No intermediates seem to be present between the varieties, but mixed collections (esp. involving var. *colorata* and var. *acuminata*) are numerous (Tölken 1981: 79-80). - [U. Eggli]

C. colorata var. **acuminata** (Reader) Tölken (J. Adelaide Bot. Gard. 6(2): 195, 1983). **T:** Australia, Victoria (*Reader* s.n. [MEL 89418a]). - **D:** S Australia; widespread and in a wide range of habitats. **I:** Tölken (1981: 64, fig. 3: R-S).

$\equiv$ *Tillaea acuminata* Reader (1898) $\equiv$ *Tillaea sieberiana* var. *acuminata* (Reader) Ewart & al. (1908) $\equiv$ *Crassula sieberiana* var. *acuminata* (Reader) Domin (1925); **incl.** *Crassula colorata* var. *tuberculata* Tölken (1981).

[2] **Ca** $\pm$ cylindrical but slightly laterally compressed, abruptly constricted in the lower $\frac{1}{2}$, gradually constricted into the slender **Sty**, with a cluster

of crustaceous brown tubercles in the lower $\frac{1}{2}$ but otherwise membranous. - [U. Eggli]

C. colorata var. **colorata** - **D:** Australia (S Western Australia, S South Australia, SW Victoria); coastal areas.

Incl. *Tillaea adscendens* Nees (1844); **incl.** *Tillaea intricata* Nees (1844) $\equiv$ *Crassula intricata* (Nees) Ostenfeld (1918).

[2] **Ca** laterally compressed, slightly constricted basally, gradually constricted into slender **Sty**, membranous, usually pale, never tuberculate but epidermal cells sometimes bulging. - [U. Eggli]

C. colorata var. **miriamiae** (Ostenfeld) Tölken (J. Adelaide Bot. Gard. 3(1): 81, 1981). **T:** Australia, Western Australia (*Davis* s.n. in *Ostenfeld* 1452 [MEL]). - **D:** Australia (Western Australia, low lying areas near Perth and the Stirling Ranges).

$\equiv$ *Crassula miriamiae* Ostenfeld (1918).

[2] **Ca** almost globose, scarcely constricted basally, abruptly constricted into the short erect **Sty**, smooth, membranous, pale. - [U. Eggli]

C. columella Marloth & Schönland (Trans. Roy. Soc. South Afr. 17: 255, 1929). **T:** RSA, Northern Cape (*Marloth* 12271 [GRA, PRE]). - **D:** RSA (Northern Cape); Succulent Karoo, quartz gravel flats and sandy or rocky slopes, autumn-flowering. **I:** Tölken (1985: 210, fig. 20: 3). **Fig. VI.b**

[18] Dwarf compact procumbent to erect sparingly branched herbs to 15 cm tall; **R** fibrous; **Br** completely covered by the densely tightly clasping imbricate **L** forming a neat quadrangular oblong **Bo** 6 - 17 mm $\varnothing$, tapering towards the somewhat obtuse apex; **L** green to yellowish-green, flattish, 4 - 8 $\times$ 6 - 12 mm, very broadly ovate, obtuse, epidermis velvety, upper face concave, lower face convex, somewhat keeled at the apex; **Inf** pedunculate rounded thyrses 3 $\times$ 1.5 cm; peduncle to 6 cm; **Sep** to 1.5 mm, triangular, acute or obtuse, margins ciliate; **Cl** tubular; **Pet** basally fused, oblong-elliptic, obtuse, 2.5 mm, cream or yellow; **Anth** brown.

C. columnaris Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 329, 1778). **T:** RSA, Western Cape (*Thunberg* 7740 [UPS, G, P-U, STB]). - **D:** Namibia, RSA.

$\equiv$ *Tetraphyle columnaris* (Thunberg) P. V. Heath (1993).

C. columnaris ssp. **columnaris** - **D:** RSA (Northern Cape, Western Cape); mainly Succulent Karoo, on gravel flats, flowers mid-winter to early spring.

Incl. *Crassula mitrata* H.-C. Friedrich (1974) $\equiv$ *Tetraphyle columnaris* var. *mitrata* (H.-C. Friedrich) P. V. Heath (1993).

[16] Perennials, dwarf, compact monocarpic, 1-stemmed, 2.5 - 7 cm tall; **R** fibrous; **Br** 3 - 4 mm $\varnothing$, completely hidden by the 8 - 10 **L**-pairs; **L** sessile,

L of a pair fused at the base, densely imbricate, becoming shorter upwards and forming a short tapering columnar **Bo** 2 - 3.5 cm Ø, lamina brownish-green, ovate, broader than long, to 10 - 15 × 15 - 30 mm Ø, margin minutely ciliate, lower face not keeled, tip rounded, sometimes mucronate; **Inf** dense terminal rounded cymose capitula 10 mm tall and to 22 mm Ø; **Sep** loriate, 1.5 - 3 mm, translucent, tips green, obtuse; **Fl** sweetly scented; **Cl** 7 - 13 mm, ventricose at the base to ampulliform, lobes linear-lorate, fused in the lower 1/3, white, tips obtuse, yellowish, 1 mm; **Fil** 1.2 - 2 mm; **Anth** yellow or brown; **NSc** reddish.

C. columnaris ssp. **prolifera** H.-C. Friedrich (Mitt. Bot. Staatssamml. München 11: 334-337, 347, fig. 9, 1974). **T**: Namibia (*Merxmiller & Giess* 3432 [M]). – **D**: S Namibia, RSA (Northern Cape); Succulent Karoo, flowers mid-winter to spring. **I**: Tölken (1985: 194, fig. 18: 2).

≡ *Tetraphyle columnaris* var. *prolifera* (H.-C. Friedrich) P. V. Heath (1993); **incl.** *Crassula semi-orbicularis* Ecklon & Zeyher (1837); **incl.** *Crassula columnaris* var. *elongata* E. Meyer ex Drège (1843) (*nom. inval.*, Art. 32.1c).

[16] Differs from ssp. *columnaris*: Only 1 - 2 cm Ø, proliferating profusely from the base forming dense groups; **L** lower face with a distinct keel; **Cl** 6 - 8 mm.

C. compacta Schönland (JLSB 31: 550, 1897). **T**: RSA, Mpumalanga (*Galpin* 1092 [GRA, BOL, K, Z]). – **D**: RSA (Mpumalanga, Free State); grassland in mountainous regions.

Incl. *Crassula compacta* var. *elatior* Baker fil. (1903); **incl.** *Crassula massonoides* Diels (1907); **incl.** *Crassula mossii* Schönland (1929).

[14] Dwarf solitary or sparingly branched compact perennials; **L** rosulate, spreading, imbricate, 2 - 4 × 2 - 3.5 cm, ovate, broadly ovate to obovate, glabrous, green often becoming reddish and with darker red spots, margin ciliate; **Inf** terminal erect thyrses to 10 cm with up to 5 pairs of **Bra** and sessile dichasia; peduncle reddish, 4 mm Ø, pubescent; **Bra** ovate to obovate, canaliculate, lower 8 × 4 mm, becoming smaller upwards; **Fl** sweetly scented; **Ped** to 2.5 mm; **Sep** oblong, 2 - 2.5 mm; **Cl** tubular, white to cream; **Pet** fused shortly at the base, spreading, oblong-obovate, 4.5 - 7 × 1.2 mm, tips spreading to recurved, obtuse; **Anth** yellow to black.

C. congesta N. E. Brown (Gard. Chron., ser. 3, 32(2): 171, 1902). **T**: RSA, Western Cape (*Chalwin* s.n. [K]). – **D**: RSA (Western Cape).

≡ *Tetraphyle congesta* (N. E. Brown) P. V. Heath (1993).

C. congesta ssp. **congesta** – **D**: RSA (Western Cape); S margin of Great Karoo, Witteberg Range, quartz flats and hills.

Incl. *Crassula pachyphylla* Schönland (1903).

[16] Perennials, dwarf, compact, monocarpic, erect, 1-stemmed, to 20 cm tall; **R** fibrous; **L** lanceolate, 15 - 30 × 8 - 13 mm, becoming shorter upwards, curved upwards, upper face flat to slightly grooved, lower face convex, surface glabrous or sparingly ciliate near the base, grey to brown-green, tip bluntly acute; **Inf** dense terminal rounded cymose capitula; **Sep** to 4 mm, lobes oblong-oblancoate, ciliate, tips rounded; **Cl** to 15 mm, ampulliform, lobes oblong-oblancoate, fused in the lower 1/3, cream, sometimes with reddish tinge, tips obtuse; **Anth** yellow.

C. congesta ssp. **laticephala** (Schönland) Tölken (JSAB 41: 101, 1975). **T**: RSA, Western Cape (*Vol-schenk* s.n. [GRA, K, SAM]). – **D**: RSA (Western Cape); W Little Karoo, quartz flats and hills.

≡ *Crassula laticephala* Schönland (1913) ≡ *Tetraphyle congesta* var. *laticephala* (Schönland) P. V. Heath (1993).

[16] Differs from ssp. *congesta*: Smaller and only to 10 cm tall; **L** sharply acute, recurved.

C. connata (Ruiz & Pavón) A. Berger (NPF2 18a: 389, 1930). **T**: Peru, Cajamarca (*Ruiz & Pavón* 10/89 [MA, FI, OXF]). – **Lit**: Moran (1992d). **D**: N and S America (Oregon [USA] to Argentina). **I**: Bywater & Wickens (1984: 725). **Fig.** VIc

≡ *Tillaea connata* Ruiz & Pavón (1798); **incl.** *Crassula connata* var. *connata*; **incl.** *Tillaea sedoides* Bertero (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Tillaea rubescens* Kunth (1823); **incl.** *Tillaea minima* Miers ex Hooker & Arnott (1833) (*nom. illeg.*, Art. 52.1) ≡ *Crassula minima* (Miers ex Hooker & Arnott) Reiche (1896) (*nom. illeg.*, Art. 53.1); **incl.** *Tillaea diffusa* Willdenow ex Steudel (1841); **incl.** *Tillaea minima* Gay (1847); **incl.** *Tillaea muscosa* Gay (1847) (*nom. illeg.*, Art. 53.1); **incl.** *Tillaea leptopetala* Benth (1849); **incl.** *Tillaea minima* var. *subsimplex* S. Watson (1876) (*incorrect name*, Art. 11.4) ≡ *Crassula connata* var. *subsimplex* (S. Watson) Bywater & Wickens (1984); **incl.** *Tillaea erecta* var. *eremica* Jepson (1925) ≡ *Tillaea erecta* ssp. *eremica* (Jepson) Wiggins (1964) ≡ *Crassula connata* var. *eremica* (Jepson) Bywater & Wickens (1984); **incl.** *Crassula connata* var. *erectoides* Bywater & Wickens (1984); **incl.** *Crassula connata* var. *muscoides* Bywater & Wickens (1984).

[2] Erect herbs to 6.5 cm, simple or sparingly branched from the base; **L** lanceolate-triangular, (0.8-) 1.8 - 3 (-6.5) × (0.4 -) 0.7 - 1 (-1.4) mm, obtuse or acute; **Fl** (1-) 2 per node, 3- to 5-merous; **Ped** (0.2-) 1 - 3 (-6) mm; **Sep** triangular, (0.6-) 0.8 - 1.4 (-2.3) × ± 0.3 - 0.7 mm, acute to aristate; **Pet** narrowly triangular, (0.6-) 0.8 - 1.2 × 0.2 - 0.4 mm, acute to attenuate; **NSc** filiform to narrowly spatulate, 0.3 - 0.6 mm; **Se** (1-) 2 per **Ca**, small, ellipsoid, ± 0.3 - 0.5 (-0.57) × 0.15 - 0.25 mm, reddish-brown, smooth, often irregularly longitudinally ridged.

A variable complex of taxa, divided into several varieties by Bywater & Wickens (1984), but here synonymized according to Moran (1992d). Vernacular name (USA): "Pygmy Weed". – [U. Eggli]

C. corallina Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 239, 334, 1778). **T:** RSA, Northern Cape (*Thunberg* 7741 [UPS]). – **D:** Namibia, RSA.

≡ *Creusa corallina* (Thunberg) P. V. Heath (1993).

C. corallina ssp. **corallina** – **D:** S Namibia, RSA (Northern Cape, Western Cape, Eastern Cape, Free State); Nama Karoo, dry flats and slopes, flowers mid-summer to autumn.

Incl. *Crassula dasyphylla* Harvey (1862).

[5] Procumbent branched perennials; **Br** to 8 cm, rooting at the nodes; main **R** to 2 mm Ø but not tuberous; **L** 3 - 5 × 2 - 3 mm, obovate to elliptic, rhombic, biconvex, swollen towards tips, surface verruculose with white waxy covering, base cuneate to subpetiolate, tip subacute to obtuse; **Inf** terminal dichasia with up to 5 pedicellate **Fl**; peduncle indistinct; **Sep** loriate, to 2 mm, obtuse; **Cl** urceolate, white or cream, lobes to 3 mm, oblong to oblanceolate, fused shortly at the base, tips recurved; **Anth** yellow; **Sty** distinct, erect; **Sti** apical.

C. corallina ssp. **macrorrhiza** Tölken (JSAB 41: 101-102, 1975). **T:** Namibia (*Dinter* 4773 [PRE, K, SAM]). – **D:** S Namibia, RSA (Northern Cape); Nama Karoo, dry flats, flowers spring to mid-summer.

≡ *Creusa corallina* ssp. *macrorrhiza* (Tölken) P. V. Heath (1993).

[5] Differs from ssp. *corallina*: Main **R** swollen, 3 - 12 mm Ø; **L** 4 - 5 × 3.5 - 5 mm, obovate to obtriangular, tips rounded; **Sty** indistinct, **Sti** lateral, sessile.

This equates *C. corallina* in the sense of most horticultural authors.

C. cordata Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 328, 330, 1778). **T:** RSA, Eastern Cape (*Thunberg* 7742 [UPS]). – **D:** RSA (Eastern Cape, KwaZulu-Natal); Bushveld, flowers mid-winter to spring.

Incl. *Crassula neglecta* Schultes (1820) (*nom. illeg.*, Art. 52.1); **incl.** *Crassula aitonii* Britten & Baker *fil.* (1898); **incl.** *Crassula glauca* Schönland (1929).

[6] Decumbent to erect sparingly branched herbs to 30 cm tall; stems and **L** with white powdery bloom; **R** fibrous; **Br** terete, to 8 mm Ø; **L** 15 - 35 × 7 - 12 mm, flat, grey-green, broadly ovate, margins reddish, with a ring of hydathodes, upper face concave to flat, lower face convex, base cordate, tip rounded to obtuse; **Inf** lax rounded to spreading thyrses 15 × 14 cm, its **Br** with adventitious plant-

lets and through their weight becoming drooping; peduncle to 15 cm; **Sep** triangular, to 2 × 1 mm; **Cl** stellate, yellowish-green to pale yellow, sometimes tinged pink; **Pet** fused at the base, lanceolate, 3 × 1 mm; **Anth** yellow.

C. cordifolia Baker (JLSB 25: 315, 1889). **T:** Madagascar (*Baron* 5194 [K ?]). – **D:** Madagascar (Ankaratra Massif); 2250 m.

[?] Glabrous perennial herbs; **Br** slender, simple, erect, angled, to 15 cm; **L** succulent, green, 5 - 8 mm, heart-shaped, basally amplexicaul and connate; **Inf** terminal panicles 5 - 8 cm Ø; **Fl** numerous, 5-merous, long pedicellate; **Sep** 4 mm, ovate-lanceolate, green with whitish margin; **Pet** 6 - 7 mm, oblong, white; **St** 4 mm;

Insufficiently known though recently recollected (Allorge-Boiteau 2002). The description given here is based on the protologue. – [U. Eggli]

C. cotyledonis Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 329, 332, 1778). **T:** RSA, Eastern Cape (*Thunberg* 7743 [UPS, G-DC]). – **D:** S Namibia, RSA (Northern Cape, Western Cape, Eastern Cape); Succulent Karoo, among rocks, flowers in mid-summer.

≡ *Purgosea cotyledonis* (Thunberg) Sweet (1830) ≡ *Globulea cotyledonis* (Thunberg) P. V. Heath (1995); **incl.** *Crassula canescens* var. *latifolia* Harvey (1862); **incl.** *Crassula rehmannii* Baker *fil.* (1903); **incl.** *Crassula dubia* Schönland (1910) ≡ *Crassula cephalophora* var. *dubia* (Schönland) Schönland (1929); **incl.** *Crassula tayloriae* Schönland (1910) ≡ *Crassula cephalophora* var. *tayloriae* (Schönland) Schönland (1929).

[20] Low-growing shrubs of variable size, to 1 m tall (excl. **Inf**), dense, solitary or with several **Ros**; **L** variable in shape and vestiture, ascending-spreading, obovate to oblong-oblanceolate, 2.5 - 10 × 1.5 - 4.5 cm, flattened, bent sideways in a distichous fashion, densely covered with short recurved **Ha**, green to grey-green, upper face flat to slightly convex, lower face flat to slightly convex, margin minutely ciliate, tip obtuse; **Inf** erect spike-like thyrses to 33 cm with several sessile to shortly stalked dichasia; peduncle hairy, with up to 7 pairs of erect ovate-triangular **Bra** to 6 mm; **Fl** densely glomerate; **Sep** oblong-triangular, to 3 mm, obtuse, margin ciliate; **Cl** tubular, cream to white, lobes shortly fused at the base, 2 - 4.5 mm, panduriform, with terminal globose appendages; **Anth** yellow.

C. cremnophila van Jaarsveld & A. E. van Wyk (Aloe 36(4): 71, ill., 2000). **T:** RSA, Eastern Cape (*van Jaarsveld* 15743 [NBG]). – **D:** RSA (Eastern Cape); sheer cliffs, thickets, flowering spring to mid-summer. **Fig. X.f**

[14] Compact sparingly branched dwarf succulents with up to 5 **Ros**, 1.2 - 2.5 cm tall; **L** rosulate, flatly spreading, imbricate and forming a semiglob-

ose **Bo** 2 - 7 cm Ø, lamina broadly obovate, 15 - 35 × 10 - 32 mm, glaucous, glabrous, tip rounded to subacute, margins ciliate; **Inf** terminal erect round-topped thyrses to 3 cm Ø; peduncle to 3.5 cm; **Fl** sessile to shortly pedicellate, scented; **Sep** tips oblanceolate, 3 × 1 mm; **Cl** to 7 mm long; **Pet** free at the base, rose-coloured.

Close to *C. hemisphaerica*.

C. crenulata Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 330, 339, 1778). **T:** RSA, Western Cape (*Thunberg* 7745 [UPS, SJ]). – **D:** RSA (KwaZulu-Natal, Western Cape, Eastern Cape); grassland and thickets, flowers mid-summer to autumn.

≡ *Purgosea crenulata* (Thunberg) G. Don (1834) ≡ *Septimia crenulata* (Thunberg) P. V. Heath (1993); **incl.** *Crassula caerulata* J. F. Gmelin (1791); **incl.** *Crassula telephioides* Haworth (1821).

[6] Erect multistemmed herbs to 40 cm tall from a tuberous base; tubers finger-shaped; stems erect, unbranched, old **L** persistent; **L** 3 - 8 × 0.5 - 2.5 cm, flat, cymbiform, sessile; basal **L** oblanceolate to elliptic, upper **L** oblong-lanceolate, margins entire to crenulate, tip obtuse to acute; **Inf** flat-topped thyrses with solitary to many dichasia; **Fl** erect; **Sep** linear-triangular, to 3 mm, acute; **Cl** stellate, to 18 mm Ø, white or cream, tinged pink; **Pet** linear-lanceolate, to 8 mm; **Anth** purple.

C. cultrata Linné (Mant. Pl. Altera, 361, 1771). **T:** [lecto – icono]: Dillenius, Hort. Eltham. 11, t. 17: fig. 114, 1732. – **D:** RSA (E part of Western Cape, Eastern Cape to S KwaZulu-Natal); Succulent Karoo and thickets, flowers in mid-summer. **Fig. VI.d**

≡ *Globulea cultrata* (Linné) Haworth (1812); **incl.** *Crassula torquata* Baker fil. (1869); **incl.** *Crassula cultrata* var. *typica* Schönland (1929) (*nom. inval.*, Art. 24.3).

[20] Decumbent to erect glabrous (rarely hairy) moderately branched herbs to 80 cm tall; **Br** green at first, ± 3 mm Ø, becoming woody with age with dark brown bark; **L** variable in shape, flattened, asymmetrical, obovate to oblanceolate, green to yellowish-green, ascending to spreading, 35 - 55 × 15 - 25 mm with petiole 5 - 10 mm, glabrous to rarely pubescent, margin green to reddish, acute, entire, base cuneate, tips obtuse to acute; **Inf** erect spike-like thyrses to 45 cm with up to 8 pairs of stalked (to 12 - 40 mm) dichasia in the upper ½; lower pair of **Bra** **L**-like, becoming smaller upwards (8 - 10 × 3 - 6 mm), triangular-lanceolate, upper face flat to channelled, lower face convex; **Sep** 2 - 3 mm, triangular-lanceolate; **Cl** tubular, cream to white, lobes shortly fused at the base, 3 - 4 mm, panduriform, with terminal ovoid appendages; **Anth** black.

C. cymbiformis Tölken (Fl. South Afr. 14: 163,

1985). **T:** RSA, Northern Prov. (*Hardy & al.* 5365 [PRE]). – **D:** RSA (Northern Prov.: Waterberg); rocky outcrops, autumn-flowering.

[14] Moderately branched decumbent to erect herbs to 20 cm tall (when flowering); **R** fibrous; **Br** firm; **L** 4-ranked, lamina 15 - 95 × 15 - 32 mm, green to reddish-green; basal **L** oblong-obovate, upper **L** lanceolate, all flat, cymbiform, glabrous, margin ciliate, base variable to almost auriculate, tip acute; **Inf** terminal flat-topped thyrses with numerous dichasia; **Ped** to 6 mm; **Sep** linear-triangular, to 1 mm; **Cl** tubular, to 5 mm; **Pet** shortly fused at the base, to 4 mm, lanceolate, spreading and becoming recurved; **Anth** black.

C. cymosa Bergius (Descr. Pl. Cap., 84, 1767). **T:** RSA, Western Cape (*Grubb* s.n. [STB]). – **D:** RSA (Western Cape); Fynbos, flowers spring to mid-summer.

≡ *Larochea cymosa* (Bergius) Haworth (1812) ≡ *Rochea cymosa* (Bergius) De Candolle (1828) ≡ *Sedum cymosum* (Bergius) Kuntze (1898); **incl.** *Crassula arenicola* Tölken (1972).

[11] Eerect freely branched rounded shrublets to 25 cm tall; **Br** woody at the base, brown, to 2.5 mm Ø; **L** linear-elliptic, 15 - 25 × 1.5 - 3 mm, ascending, flattish, glabrous, upper face flat to convex, lower face convex, margin ciliate, tips acute to subulate; **Inf** rounded to flat-topped thyrses 15 × 20 mm with several dense dichasia; peduncle ± 11 cm tall with a continuum from **L** to **Bra**; **Ped** to 1 mm or mostly absent; **Sep** linear-lanceolate, 2 mm; **Cl** tubular, 4 × 3 mm Ø, white; **Pet** linear-lanceolate, 3.5 mm, fused in the lower ½; **Anth** yellow.

C. deceptor Schönland & Baker fil. (J. Bot. 40: 285, 1902). **T:** RSA, Northern Cape (*Alston* s.n. [GRA]). – **D:** S Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, quartz gravel flats and gravelly or rocky slopes, flowers mid-summer to autumn. **I:** Tölken (1985: 210, fig. 20: 1). **Fig. VI.a**

Incl. *Crassula cornuta* Schönland & Baker fil. (1902); **incl.** *Crassula arta* Schönland (1929); **incl.** *Crassula deceptor* Schönland (1929) (*nom. illeg.*).

[18] Dwarf compact erect solitary or sparingly branched herbs to 6 cm tall; **R** fibrous; **Br** 5 - 8 mm Ø with densely imbricate clasping **L** forming a quadrangular oblong **Bo** 2.5 cm Ø tapering towards the tip; **L** 7 - 18 × 3 - 15 mm, ovate-triangular to broadly ovate, obtuse, grey-green, epidermis papillate, margins entire, upper face concave, lower face convex, somewhat cymbiform and sometimes keeled near the tip; **Inf** pedunculate rounded thyrses to 2 × 2 cm; peduncle to 8 cm; **Sep** to 1.5 mm, oblong-triangular, acute or obtuse, margins ciliate; **Cl** tubular, to 2.5 mm, cream or yellow, lobes oblong-elliptic, obtuse or acute, fused basally; **Anth** brown.

The number of synonyms reflects the variability in leaf shape and arrangement, but intermediates

between the formally described (and frequently cultivated) populations defy any formal classification.

C. decidua Schönland (Trans. Roy. Soc. South Afr. 17: 258, 1929). **T** [lecto]: RSA, Eastern Cape (*Dyer* 869 [GRA, K, L, PRE]). – **D**: RSA (Eastern Cape); Noorsveld among *Euphorbia* thickets, flowers mid-summer to autumn.

[17] Little-branched erect shrublets to 6 cm tall; **R** fibrous; main **Br** slightly fleshy at the base; **L** 10 - 35 × 6 - 15 mm, completely deciduous at fruiting time, flattish, biconvex, obovate-cultriform, lamina grey-green, papillate at first becoming glabrous, tip obtuse; **Inf** spike-like thyrses with dense dichasia; **Sep** to 2.5 mm, triangular, acute, hairy with ciliate margins; **Cl** tubular, to 4.5 mm, lobes linear-oblan-ceolate, cream, to 3.5 mm, tips acute to obtuse with a dorsal appendage; **Anth** black.

The completely deciduous leaves are a unique feature in this section.

C. decumbens Thunberg (Prodr. Fl. Cap., 54, 1794). **T** [lecto]: RSA, Cape Prov. (*Thunberg* 7751 [UPS, BM, STB]). – **D**: Chile, Australia, Mongolia, RSA

≡ *Gomara decumbens* (Thunberg) P. V. Heath (1995).

C. decumbens var. **brachyphylla** (Adamson) Tölken (JSAB 41: 102, 1975). **T**: RSA, Cape Prov. (*Ecklon & Zeyher* 1852 [G, GRA, K, LE, S, SAM]). – **D**: RSA (Western Cape, Northern Cape); close to the coast in salt marshes, flowers in spring and early summer.

≡ *Crassula brachyphylla* Adamson (1942); **incl.** *Bulliarda brevifolia* Ecklon & Zeyher (1837) ≡ *Tillaea brevifolia* (Ecklon & Zeyher) Walpers (1843) ≡ *Crassula brevifolia* (Ecklon & Zeyher) Schönland (1917) (*nom. illeg.*, Art. 53.1).

[2] Differs from var. *decumbens*: mat-forming and occurring in dense stands: **L** to 5 mm, cylindrical to club-shaped, tip obtuse; **Cl** lobes broadly ovate, often 2× as long as the **Cal** lobes.

C. decumbens var. **decumbens** – **D**: Chile, Australia, Mongolia, RSA (Northern Cape, Western Cape); in RSA in Succulent Karoo, sandy regions near pools, flowering from late spring to mid-summer. **I**: Bywater & Wickens (1984: 720, fig. 5: A-E).

Incl. *Bulliarda trichotoma* Ecklon & Zeyher (1837) ≡ *Tillaea trichotoma* (Ecklon & Zeyher) Walpers (1843); **incl.** *Tillaea macrantha* Hooker fil. (1841) ≡ *Crassula macrantha* (Hooker fil.) Diels & Pritzel (1904); **incl.** *Tillaea ovallei* Philippi (1872) ≡ *Crassula ovallei* (Philippi) Reiche (1897); **incl.** *Tillaea radicans* Philippi (1872) ≡ *Crassula radicans* (Philippi) Reiche (1897) (*nom. illeg.*, Art. 53.1); **incl.** *Tillaea macrantha* var. *sepalosa* F.

Mueller (1881); **incl.** *Crassula mongolica* Franchet (1882) ≡ *Tillaea mongolica* (Franchet) S. H. Fu (1965); **incl.** *Tillaea micrantha* Tate (1890) (*nom. inval.*, Art. 61.1); **incl.** *Tillaea rencana* Philippi (1894); **incl.** *Crassula leipoldtii* Schönland & Baker fil. (1902); **incl.** *Crassula macrantha* var. *nuda* Ostenfeld (1916); **incl.** *Crassula langebergensis* Schönland (1929).

[2] Decumbent to erect annuals to 12 cm tall or much shorter, freely branching from the base and forming small groups, rarely mat-forming; **L** 3 - 10 × 0.5 - 2 mm, sessile, linear-lanceolate, oblanceolate to elliptic, subulate, glabrous, green to reddish-brown, upper face flat, lower face convex, tip acute with a terminal papilla; **Inf** thyrses with numerous dichasia (1 - 2 **Fl** per node); **Fl** pedicellate, 4- (outside Africa) or 5-merous (Africa); **Sep** ovate to lanceolate, (1.3-) 1.9 - 2.4 × 0.3 - 0.8 mm, margin denticulate; **Cl** cup-shaped, white to cream; **Pet** ovate to lanceolate, (1-) 1.5 - 1.9 × 0.6 - 0.9 mm, acute, equal or shorter than the **Sep**; **NSc** obtriangular, 0.4 × 0.3 mm; **Se** oblong, 0.44 - 0.5 × ± 0.23 mm, reddish-brown, densely papillate.

Closely related to *C. closiana* (sepals papillate) and *C. connata* (seeds slightly ridged). – [E. van Jaarsveld & U. Eggli]

C. dejecta Jacquin (Pl. Hort. Schoenbr. 4: t. 433, 1804). **T**: RSA, Western Cape (*Jacquin* s.n. [W]). – **D**: RSA (Northern Cape, Western Cape); Succulent Karoo and Fynbos, rocky areas, flowers mid-summer. **Fig. VI.e**

≡ *Curtogyne dejecta* (Jacquin) De Candolle (1828); **incl.** *Crassula microsquamata* Schönland in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Crassula undulata* Haworth (1803) ≡ *Curtogyne undulata* (Haworth) Haworth (1821); **incl.** *Crassula undata* Haworth (1819) ≡ *Curtogyne undata* (Haworth) Haworth (1821); **incl.** *Crassula albiflora* Sims (1823) ≡ *Rochea albiflora* (Sims) De Candolle (1828) ≡ *Curtogyne albiflora* (Sims) Ecklon & Zeyher (1837); **incl.** *Curtogyne undosa* Haworth (1828); **incl.** *Crassula albiflora* var. *minor* Schönland (1929).

[12] Much-branched rounded subshrubs to 40 cm tall; older **Br** becoming woody; younger **Br** reddish, with recurved **Ha**, becoming grey-brown, 3 - 7 mm Ø; **L** flat above, flat to slightly convex below, 20 - 35 × 15 - 20 mm, ovate, ovate-lorate to oblong-elliptic, minutely papillate, without **Ha**, margin acute, ciliate, decurrent at the base, base almost cordate, tip obtuse; **Inf** erect rounded thyrses, 7 cm tall, to 11 cm Ø, with several dichasia; peduncle indistinct; **Ped** short, 1.5 - 3 mm; closed buds to 8 mm; **Sep** 5 mm, linear-lanceolate, 3 × 1.5 mm, reddish; **Cl** tubular below, stellate above and to 1 cm Ø, white; **Pet** fused shortly at the base, tips spreading, oblong-oblan-ceolate, to 6 - 7 mm; **Anth** brown.

C. deltoidea Thunberg (Nova Acta Phys.-Med.

Acad. Caes. Leop.-Carol. Nat. Cur. 6: 239, 334, 1778). **T:** RSA, Northern Cape (*Thunberg* 7754 [UPS, G-DC, S]). – **D:** RSA (Northern Cape, Western Cape); Nama Karoo, dry flats, flowers spring to mid-summer. **Fig. VI.f**

≡ *Creusa deltoidea* (Thunberg) P. V. Heath (1993); **incl.** *Crassula rhomboidea* N. E. Brown (1886).

[5] Decumbent to erect perennials with short spreading **Br** to 8 cm; **R** fibrous plus a main tap~~R~~; older **L** deciduous; **L** variable in size, 10 - 20 × 4 - 15 mm, narrowly to broadly deltoid to oblanceolate, upper face flat to concave, lower face markedly convex, surface grey-green with white waxy covering, base cuneate, tip acute to subacute; **Inf** terminal rounded thyrses with numerous dichasia; peduncle to 1 cm; **Sep** broadly triangular, to 2 mm, obtuse; **Cl** urceolate, white or cream, lobes to 5 mm, narrowly elliptic to oblanceolate, fused shortly at the base, tips rounded; **Anth** black.

C. dentata Thunberg (Prodr. Fl. Cap., 57, 1794). **T:** RSA, Western Cape (*Thunberg* 7755 [UPS, LU, S, STB]). – **D:** RSA (Northern Cape, Western Cape); mountains, shade of rocks, flowers spring to mid-summer. **I:** Tölken (1985: 140, fig. 15: 2).

≡ *Purgosea dentata* (Thunberg) G. Don (1834) ≡ *Septas dentata* (Thunberg) P. V. Heath (1993); **incl.** *Crassula minima* Thunberg (1794) ≡ *Purgosea minima* (Thunberg) G. Don (1834); **incl.** *Petrogeton patens* Ecklon & Zeyher (1837) ≡ *Crassula patens* (Ecklon & Zeyher) Endlicher ex Walpers (1843); **incl.** *Petrogeton typicum* Ecklon & Zeyher (1837); **incl.** *Petrogeton typicum* var. *minus* Ecklon & Zeyher (1837); **incl.** *Crassula petrogeton* Endlicher ex Walpers (1843); **incl.** *Crassula dentata* var. *minor* Harvey (1862); **incl.** *Crassula marlothii* Schönland (1897); **incl.** *Crassula dielsii* Schönland (1904).

[7] Geophytes with erect unbranched stems to 20 cm; tuber globose with fibrous adventitious **R**; **L** in more than 3 pairs, basal **L** in whorls of 4, spatulate with petioles to 7 cm; upper **L** 3 - 20 × 3 - 25 mm, opposite, obovate to elliptic ovate to orbicular, margin entire to dentate, surface glabrous, rarely hairy, green, base cuneate, tip rounded to subacute; **Inf** terminal and axillary; peduncle absent; **Sep** triangular-lanceolate, to 1.5 mm, acute to obtuse; **Cl** stellate, to 8 mm Ø, white to cream, lobes lanceolate, to 3.5 mm, tips spreading; **Anth** yellow.

C. dependens Bolus (JLSB 18: 391, 1881). **T:** RSA, Eastern Cape (*Bolus* 658 [BOL, K, GRA, SAM]). – **D:** Namibia, Lesotho, RSA (Northern Cape, Eastern Cape, Free State); Nama Karoo and grassland, mainly on Beaufort Shales in shallow soil.

≡ *Crassula harveyi* var. *dependens* (Bolus) Schönland (1929); **incl.** *Crassula griquaensis* Schönland (1897); **incl.** *Crassula harveyi* Britten & Baker fil. (1897) ≡ *Creusa revolvens* var. *harveyi*

(Britten & Baker fil.) P. V. Heath (1993); **incl.** *Crassula laxa* Schönland (1897); **incl.** *Crassula basutica* Schönland (1913); **incl.** *Crassula montismoltkei* Dinter (1923); **incl.** *Crassula harveyi* var. *intermedia* Schönland (1929) ≡ *Creusa revolvens* var. *intermedia* (Schönland) P. V. Heath (1993); **incl.** *Crassula harveyi* var. *typica* Schönland (1929) (*nom. inval.*, Art. 24.3).

[9] Decumbent to prostrate moderately branched mat-forming glabrous herbs to 5 cm tall; **Br** 1 mm Ø, green, young covered with **Ha**-like papillae, older **Br** with brown bark, main stem to 3 mm Ø; **L** spreading-ascending, 8 - 12 × 2 - 2.5 mm, green to reddish, linear-lanceolate, flattened, biconvex, tips acute; older **L** persistent; **Inf** flat-topped thyrses with numerous lateral dichasia; peduncle indistinct; **Sep** to 4 mm; **Cl** white to cream, tubular, to 6 mm, lobes fused shortly at the base; **Anth** brown.

C. depressa (Ecklon & Zeyher) Tölken (Contr. Bolus Herb. 8: 153, 1977). **T:** RSA, Western Cape (*Ecklon & Zeyher* 1937 [S]). – **D:** RSA (Western Cape); Strandveld, flowers in spring and early summer.

≡ *Grammanthes depressa* Ecklon & Zeyher (1837) ≡ *Grammanthes gentianoides* var. *depressa* (Ecklon & Zeyher) Harvey (1862).

[3] Erect glabrous freely branched annuals to 5 cm tall; **R** fibrous; **L** 4 - 15 × 2 - 5 mm, flat, oblanceolate to elliptic, somewhat cymbiform, tip acute to obtuse; **Inf** thyrses with few dichasia; **Cal** lobes to 1.5 mm, broadly triangular; **Cl** tubular, lobes to 4 mm, shortly fused at the base, white to pinkish, oblong-elliptic, acute or obtuse; **Anth** yellow.

C. dichotoma Linné (Pl. Rar. Afr., 9, 1760). **T:** [lecto - icono]: Hermann, Horti Acad. Lugd.-Bat. Cat., t. 553, 1687. – **D:** RSA (Northern Cape, Western Cape); Strandveld, spring-flowering. **Fig. VI.g**

≡ *Vauanthes dichotoma* (Linné) Kuntze (1891); **incl.** *Crassula retroflexa* Thunberg (1778) ≡ *Grammanthes retroflexa* (Thunberg) Sweet (1830); **incl.** *Crassula gentianoides* Lamarck (1785) ≡ *Grammanthes gentianoides* (Lamarck) DeCandolle (1828); **incl.** *Vauanthes chloraeflora* Haworth (1821) (*nom. illeg.*) ≡ *Grammanthes chloraeflora* (Haworth) DeCandolle (1828) ≡ *Crassula chloraeflora* (Haworth) D. Dietrich (1840) ≡ *Grammanthes gentianoides* var. *chloraeflora* (Haworth) Harvey (1862); **incl.** *Grammanthes gentianoides* var. *vera* Harvey (1862); **incl.** *Grammanthes chloraeflora* var. *caesia* Hooker fil. (1878).

[3] Erect glabrous dichotomously branched annuals, 0.6 - 11.5 cm tall; **R** fibrous; **Br** to 2 mm Ø, terete; **L** 5 - 18 × 4 - 10 mm, ovate-lanceolate, elliptic to obovate, somewhat cymbiform, purplish-green to grey-green, ascending-spreading, lower **L** deciduous towards anthesis, tips acute to obtuse; **Inf** terminal thyrses; **Bra** 7 × 2 mm, lanceolate; **Ped** 2 - 7

mm; **Cal** lobes 7 mm, basally fused for 4 mm, tips succulent, triangular-ovate, convex; closed **Cl** 20 mm, tubular; **Pet** basally fused for 5 mm, lobes 10 × 4 mm, lanceolate to elliptic, yellow to orange, spreading in sunny conditions; **Fil** 9 mm, fused to the **Cl** for the lower 4 mm; **Ca** 5 mm; **Sty** 4 mm; **Sti** terminal.

C. dodii Schönland & Baker *fil.* (J. Bot. 36: 372, 1898). **T**: RSA, Western Cape (*Schlechter* 10994 [GRA, BM, BOL, E, G, K, W, Z]). – **D**: RSA (Western Cape); Succulent Karoo, seasonally moist depressions, spring-flowering.

[2] Decumbent glabrous annuals to 5 cm Ø; **R** fibrous; **L** 2 - 4 × 2 - 3 mm, flat, clustered in groups of 4, petiole to 3 mm, lamina elliptic to ovate, tip obtuse; **Inf** thyrses with 1 to several dichasia; **Ped** 3 - 5 mm; **Fl** 4-merous; **Cal** lobes lanceolate, to 1.5 mm, obtuse; **Cl** cup-shaped, white, lobes oblong-elliptic, to 1.7 mm; **Anth** yellow.

C. drummondii (Torrey & Gray) Fedde (Just's Bot. Jahresber. 31: 829, 1904). **T** [lecto]: USA, Texas (*Drummond* III,95 [GH, BM, GOET, K]). – **D**: S USA (Colorado, Arizona, Texas), Paraguay, Argentina, Chile; seasonally damp areas, margins of pools and rivers. **I**: Bywater & Wickens (1984: 717, fig. 4: F-K).

≡ *Tillaea drummondii* Torrey & Gray (1840) ≡ *Tillaeastrum drummondii* (Torrey & Gray) Britton (1903) ≡ *Hydrophila drummondii* (Torrey & Gray) House (1920) (*incorrect name*, Art. 11.4) ≡ *Tillaea aquatica* var. *drummondii* (Torrey & Gray) Jepson (1925).

[1] Erect or decumbent herbs, aquatic **Br** to 4 cm; **L** linear-lanceolate, 1.5 - 3 mm, obtuse; **Fl** 1 per node, 4-merous; **Ped** (0.5-) 1 - 1.3 (-2) mm; **Sep** triangular, 0.4 × 0.3 mm; **Pet** lanceolate, 1.3 × 0.3 mm; **NSc** not described; **Se** (9-) 13 - 15 per **Ca**, oblong to ellipsoid, reddish-brown, ± 0.28 - 0.39 (-0.48) × 0.14 - 0.18 (-0.21) mm, papillate.

The original concept of this taxon also included material now referred to *C. longipes*. The small and numerous papillate seeds with 1 papilla per cell distinguish *C. drummondii* from other dwarf ephemeral crassulas. – [U. Eggli]

C. elatinoides (Ecklon & Zeyher) H.-C. Friedrich (Mitt. Bot. Staatssamml. München 15: 584, fig. 4, 1979). **T**: RSA, Western Cape (*Ecklon & Zeyher* 1849 [G, K, LE, M, P, S, SAM]). – **D**: RSA (Western Cape); Fynbos, shallow rock pockets with humus, spring-flowering.

≡ *Bulliarda elatinoides* Ecklon & Zeyher (1837) ≡ *Tillaea elatinoides* (Ecklon & Zeyher) Walpers (1843).

[1] Soft erect glabrous green to reddish succulent annual herbs to 6 cm tall, branched from the base; **R** fibrous; **L** 3 - 5 × 1 mm, variable, linear to oblanceolate to almost club-shaped, upper face flat, lower

face convex, tip obtuse; **Inf** thyrses; **Sep** triangular, to 0.4 mm; **Cl** lobes obovate, white, to 1.5 mm, obtuse, tips spreading.

C. elegans Schönland & Baker *fil.* (J. Bot. 40: 286, 1902). **T**: RSA, Northern Cape (*Alston* s.n. [GRA]). – **D**: Namibia, RSA.

C. elegans ssp. *elegans* – **D**: S Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, quartz gravel flats and sandy or rocky slopes, flowers mid-summer to autumn. **I**: Tölken (1985: 203, fig. 19: 4).

Incl. *Crassula mesembrianthoides* Schönland & Baker *fil.* (1902) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula globosa* N. E. Brown (1911); **incl.** *Crassula humilis* N. E. Brown (1911); **incl.** *Crassula densa* N. E. Brown (1912); **incl.** *Crassula dinteri* Schönland (1929); **incl.** *Crassula liquiritiodora* Dinter (1931) (*nom. inval.*, Art. 32.1c); **incl.** *Crassula corpusculariopsis* Boom (1955); **incl.** *Crassula schoenlandii* H. Jacobsen (1955).

[18] Dwarf, sparingly to densely branched, forming spreading tufts 5 × 9 cm; **R** fibrous; **L** in basal **Ros**, old **L** persistent; **Br** short, to 2 mm Ø below the **L**; **L** variable in shape, colour and texture, lamina obovate, ovate, broadly ovate, elliptic to lanceolate, 3 - 15 × 3 - 8 mm, flat to rarely almost globose, upper face flat to convex, lower face convex to cymbiform, epidermis hairy or glabrous, grey-green, green or purplish-red, tip obtuse or rounded; **Inf** globose thyrses; peduncle to 6 cm; **Sep** triangular, to 1.5 mm, obtuse, margins ciliate; **Cl** tubular; **Pet** fused at the base for 2.5 mm, white to yellowish, lobes loriate-elliptic; **Anth** brown.

C. elegans ssp. *namibensis* (H.-C. Friedrich) Tölken (JSAB 41: 12, 1975). **T** [neo]: Namibia (*Merxmiller & Giess* 3477 [M]). – **D**: S Namibia; Succulent Karoo, flowers mid-summer to autumn.

≡ *Crassula namibensis* H.-C. Friedrich (1967); **incl.** *Crassula mesembryanthemoides* Dinter & A. Berger (1914) (*nom. illeg.*, Art. 53.1).

[18] Differs from ssp. *elegans*: Stem basally somewhat carnose-woody; **L** papillate.

C. elsiae Tölken (JSAB 41: 102-103, 1975). **T**: RSA, Western Cape (*Esterhuysen* 14958 [BOL, K, SAM]). – **D**: RSA (Western Cape); quartzitic sandstone rocks, summer-flowering.

[5] Procumbent to decumbent little branched perennials with rooting **Br** to 10 cm; **R** fibrous; **L** 2 - 4 × 2 - 3 mm, flattened, swollen towards tips, lamina obovate, verruculose, green to green-brown, base cuneate, apex obtuse; **Inf** terminal dichasia with up to 5 pedicellate **Fl**; peduncle indistinct; **Sep** loriate, to 2 mm, obtuse; **Cl** urceolate, white or cream, lobes to 3 mm, oblong to oblanceolate, fused shortly at the base, tips recurved; **Anth** yellow.

C. ericoides Haworth (Philos. Mag. J. 66: 30, 1825). **T:** K [lecto: unpubl. pl. 783]. – **D:** RSA.

≡ *Creusa ericoides* (Haworth) P. V. Heath (1993).

C. ericoides ssp. **ericoides** – **D:** RSA (Western Cape, Eastern Cape, KwaZulu-Natal); rocky places in shallow soil in thickets, Fynbos and grassland, flowers mid-summer to autumn. **Fig. VII.a**

Incl. *Tetraphyle furcata* Ecklon & Zeyher (1837) ≡ *Crassula furcata* (Ecklon & Zeyher) Endlicher ex Walpers (1843); **incl.** *Crassula jacobsoniana* von Poellnitz (1936).

[9] Erect sparingly to moderately branched glabrous herbs to ± 35 cm, variable in size and **L** shape; **Br** to 2 mm Ø, green, older **Br** with brown bark peeling in horizontal strips, main stem to 1 cm Ø; **L** ascending-spreading, densely 4-ranked, becoming gradually smaller towards the **Br** tips, 3 - 12 × 2 - 2.5 mm, lanceolate, flattened, tips acute, green to reddish; older **L** persistent; **Inf** sessile rounded thyrses to 1 cm Ø with 1 to several dichasia; **Ped** 0.5 - 3 mm; **Sep** to 3 mm, oblong, convex; **Cl** tubular, white to cream, lobes fused shortly at the base, oblong-elliptic, to 5 mm, tips acute; **Anth** brown.

C. ericoides ssp. **torulosa** Tölken (JSAB 41: 103-104, 1975). **T:** RSA, Western Cape (*Tölken* 3757 [BOL]). – **D:** RSA (Western Cape); mountainous Fynbos in shallow soil, flowers mid-summer to autumn.

≡ *Creusa ericoides* ssp. *torulosa* (Tölken) P. V. Heath (1993).

[9] Differs from ssp. *ericoides*: Decumbent to prostrate, main **Br** tortuous; **L** to 4 × 1.5 mm; **Cl** to 4 mm long, lobes spreading.

C. exilis Harvey (FC 2: 347, 1862). **T:** RSA, Northern Cape (*Whitehead* s.n. [TCD]). – **D:** Namibia, RSA.

C. exilis ssp. **cooperi** (Regel) Tölken (JSAB 41: 104, 1975). **T:** LE. – **D:** RSA (Northern Cape, Eastern Cape); Nama Karoo in the shade of rocks, mid-summer-flowering.

≡ *Crassula cooperi* Regel (1874); **incl.** *Crassula bolusii* Hooker (1875); **incl.** *Sedum regelii* Kuntze (1898); **incl.** *Crassula picturata* Boom (1957); **incl.** *Crassula cooperi* var. *subnodulosa* R. Fernandes (1978).

[14] Differs from ssp. *exilis*: Mat-forming; **L** oblanceolate to obovate, 6 - 45 × 3 - 10 mm; **Inf** flat-topped thyrses with hairy peduncle.

C. exilis ssp. **exilis** – **D:** RSA (Northern Cape); shade of rocks, flowers autumn to mid-winter. **I:** Aloe 32: 51, 1997.

Incl. *Crassula petraea* Schönland (1929); **incl.** *Crassula setulosa* var. *robusta* Schönland (1929).

[14] Rosulate, proliferating from the base to form dense clusters to 3 cm tall (excl. **Inf**); **R** fibrous; **L** 5

- 12 × 1.5 - 2.5 mm, spirally arranged, ascending-spreading, flattish, upper face convex, lower face markedly convex, linear-elliptic, light to dark green, spotted, glabrous, margins ciliate, tips acute; **Inf** terminal flat-topped thyrses with up to 5 dichasia with pedicellate **Fl**; **Sep** to 2.5 mm, narrowly to broadly triangular, margin ciliate, tip acute with a firm apical **Ha**; **Cl** white, tubular, 5 mm; **Pet** oblong-obovate, to 4 mm with acute tips; **Anth** yellow.

C. exilis ssp. **sedifolia** (N. E. Brown) Tölken (JSAB 41: 104, 1975). **T:** RSA (*McOwan* s.n. [K]). – **D:** S Namibia, RSA (Northern Cape); Nama Karoo, in shade of rocks, flowers late summer to autumn.

≡ *Crassula sedifolia* N. E. Brown (1902); **incl.** *Crassula aurosensis* Dinter (1928) (*nom. inval.*, Art. 32.1c).

[14] Differs from ssp. *exilis*: **Br** woody, shorter, to 1 cm Ø with a thick main **R**; **L** linear-elliptic; **Inf** irregularly branched with spreading **Fl**; peduncle glabrous.

C. cooperi and *C. picturata* in the sense of some authors belong here.

C. expansa Aiton (Hort. Kew. 1: 390, 1789). **T:** RSA, Cape Prov. (*Masson* s.n. [BM]). – **D:** S Africa, Madagascar.

≡ *Sedum expansum* (Aiton) Kuntze (1898).

C. expansa ssp. **expansa** – **D:** RSA (KwaZulu-Natal, Northern Cape, Eastern Cape, Western Cape); flowers mid-summer but also sporadically throughout the year. **Fig. VII.b**

Incl. *Crassula prostrata* Thunberg (1794); **incl.** *Crassula parviflora* E. Meyer ex Drège (1843) (*nom. nud.*); **incl.** *Crassula albicaulis* Harvey (1862); **incl.** *Crassula expansa* var. *longifolia* R. Fernandes (1978); **incl.** *Crassula maputensis* R. Fernandes (1978).

[4] Spreading delicate mat-forming perennials to 6 cm tall and 50 cm Ø; **R** fibrous; **Br** green to reddish, glabrous, to 2.5 mm Ø, rooting at the nodes; **L** sessile, flat, 6 - 12 × 4 - 6 mm, obovate to linear obovate or rarely nearly terete (Northern Cape forms), green, often shiny, upper face flat, lower face convex, margin often reddish with a ring of hydathodes, base cuneate, tip acute; **Fl** axillary, solitary; **Ped** 6 - 18 mm; **Cal** lobes 2 - 5 mm, linear; **Cl** stellate, 4 × 6 mm Ø, white, often tinged red.

C. expansa ssp. **filicaulis** (Haworth) Tölken (JSAB 41: 105, 1975). **T:** K [lecto: unpubl. pl. 768]. – **D:** RSA (Eastern Cape, Western Cape); coastal dunes and limestones in dune thickets, flowers mid-winter to mid-summer.

≡ *Crassula filicaulis* Haworth (1824); **incl.** *Crassula maritima* Schönland (1897); **incl.** *Crassula uniflora* Schönland (1929).

[4] Differs from ssp. *fragilis*: **Br** swollen, with

stilt-**R**; **L** brownish-green to reddish, crowded at the **Br** tips, lanceolate, 6×1.5 mm, trigonous to almost terete, upper face flat to slightly convex, tip acute to obtuse.

C. expansa ssp. **fragilis** (Baker) Tölken (JSAB 41: 105, 1975). **T**: Madagascar (*Baron* 3348 [K]). – **D**: Madagascar, E tropical Africa from RSA (Eastern Cape) to Tanzania; in savanna, flowers mid-summer to autumn (RSA). **Fig. VII.d**

≡ *Crassula fragilis* Baker (1887); **incl.** *Crassula woodii* Schönland (1897); **incl.** *Crassula zimmermannii* Engler (1907); **incl.** *Crassula browniana* Burt Davy (1926); **incl.** *Crassula thorncroftii* Burt Davy (1926); **incl.** *Crassula fragilis* var. *suborbicularis* R. Fernandes (1978).

[4] Differs from ssp. *expansa*: Plants spreading, without stilt-**R**; **Br** reddish; **L** shortly petiolate to 2 - 3 mm, lamina 3 - 7 $\times$ 3 - 5 mm, obovate to ovate, flat, hairy to glabrous, tip acute to obtuse; **Fl** axillary, stellate, 6 mm $\varnothing$; **Ped** 7 - 10 mm; **Sep** linear, 2 mm; **Cl** lobes lanceolate, 3.5 mm, white.

C. expansa ssp. **pyrifolia** (Compton) Tölken (JSAB 41: 106, 1975). **T**: RSA, Cape Prov. (*Moller* s.n. in *Compton* 3954 [BOL, K]). – **D**: SW Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, flowers spring to mid-summer.

≡ *Crassula pyrifolia* Compton (1932).

[4] Differs from ssp. *fragilis*: **Br** with rigid stilt-**R**; **L** oblanceolate to almost club-shaped, lamina 10 - 15 $\times$ 3.5 - 5 mm, glabrous and shiny, base cuneate, tip obtuse, rarely acute, margin green to brownish green with few scattered hydathodes; **Fl** in up to 14-flowered terminal clusters; peduncle 6 mm; **Ped** 3 - 6 mm; **Cal** lobes triangular, 1 mm; **Cl** short, 1.5 mm, white.

C. exserta (Reader) Ostenfeld (Dansk. Bot. Ark. 2(8): 48, 1918). **T**: Australia, Victoria (*Reader* s.n. [MEL 90891]). – **D**: S Australia; widely scattered, usually on sandy clay in low-lying areas. **I**: Tölken (1981: 64, fig. 3: D-E).

≡ *Tillaea exserta* Reader (1897) ≡ *Crassula sieberiana* var. *exserta* (Reader) Domin (1925).

[2] Annuals with erect stems to 15 cm, little-branched from the base; **L** lanceolate, 1.5 - 3 $\times$ 1 - 2 mm, obtuse (rarely acute), flat or almost so, upper face flat, lower face convex, fleshy, glabrous to rugose, green to deep red; **Inf** 1 to several thyrsoids (rarely panicles) with sessile dichasia in the **Ax** of **L**-like **Bra**; **Fl** 5-merous; **Ped** 0.5 - 2.5 (-5) mm at **Fr** stage; **Sep** lanceolate, 1 - 1.3 mm with colourless tip; **Cl** cup-shaped, white to red; **Pet** scarcely fused, linear-lanceolate, 0.8 - 1 mm, acute; **NSc** linear; **Se** 2 per **Ca**, smooth or almost so.

Similar to *C. sieberiana*, but with 5-merous flowers. – [U. Eggli]

C. fallax H.-C. Friedrich (Mitt. Bot. Staatssamml.

München 11: 323-327, 339, fig. 1, 1974). **T**: RSA, Western Cape (*Hall* 3053 [M, NBG]). – **D**: RSA (Western Cape); Succulent Karoo and Fynbos, rocky areas, flowers mid-summer.

[12] Much-branched rounded shrublets to 30 cm tall; older **L** persistent; **Br** to 3 mm $\varnothing$, glabrous, green, becoming reddish-brown; **L** flat on both faces, 12 - 20 $\times$ 4 - 7 mm, lorate to lorate-lanceolate, minutely papillate, without **Ha**, margins acute, ciliate, decurrent at the base, tip obtuse; **Inf** erect rounded to flat-topped thyrses 14 cm tall with several dichasia; peduncle with gradual transition from **L** to **Bra**; **Ped** short, 1 - 5 mm; **Sep** 4 mm, linear-lanceolate, green, tips acute with a translucent subulate appendage; buds to 6 mm; **Cl** white, tubular; **Pet** fused shortly at the base, stellate above, and **Fl** to 8 mm $\varnothing$, oblong-ob lanceolate, 6 - 8 mm; **Anth** brown.

C. fascicularis Lamarck (Encycl. 2: 171, 1786). **T**: RSA, Western Cape (*Anonymus* s.n. [P-LA]). – **D**: RSA (Western Cape); mountainous Fynbos, acid soil on quartzitic sandstone, flowers spring to early summer. **Fig. VII.c**

≡ *Larochea fascicularis* (Lamarck) J. A. Schultes (1820) ≡ *Rochea fascicularis* (Lamarck) De Candolle (1828) ≡ *Kalosanthes fascicularis* (Lamarck) G. Don (1834); **incl.** *Crassula odoratissima* Andrews (1797) ≡ *Larochea odoratissima* (Andrews) Haworth (1812) ≡ *Kalosanthes odoratissima* (Andrews) Haworth (1821) ≡ *Rochea odoratissima* (Andrews) Link (1821) ≡ *Dietrichia odoratissima* (Andrews) Trattinnick ex Ecklon & Zeyher (1837); **incl.** *Crassula biconvexa* Haworth (1803) ≡ *Kalosanthes biconvexa* (Haworth) Haworth (1824) ≡ *Rochea biconvexa* (Haworth) De Candolle (1828); **incl.** *Kalosanthes bicolor* Haworth (1821) ≡ *Rochea odoratissima* var. *bicolor* (Haworth) De Candolle (1828) ≡ *Dietrichia bicolor* (Haworth) Ecklon & Zeyher (1837) ≡ *Rochea bicolor* (Haworth) Steudel (1840); **incl.** *Kalosanthes media* Haworth (1821) ≡ *Rochea media* (Haworth) De Candolle (1828) ≡ *Dietrichia media* (Haworth) Ecklon & Zeyher (1837) ≡ *Crassula media* (Haworth) D. Dietrich (1840); **incl.** *Crassula capitata* Loddiges (1825) (*nom. illeg.*, Art. 53.1) ≡ *Kalosanthes capitata* (Loddiges) Sweet (1830); **incl.** *Rochea odoratissima* var. *alba* De Candolle (1828) ≡ *Kalosanthes odoratissima* var. *alba* (De Candolle) G. Don (1834); **incl.** *Dietrichia jasminea* var. *uniflora* Ecklon & Zeyher (1837); **incl.** *Larochea tiniflora* Lemaire (1861).

[13] Erect sparingly branched perennial shrublets to 25 cm tall; **Br** to 4 mm $\varnothing$; **Int** visible; **L** ascending, 20 - 35 $\times$ 4 - 6 mm, flattish, linear to linear-lanceolate, glabrous, upper face channelled, lower face convex, margin ciliate, tip acute; **Inf** cymose-capitate thyrses to 5.5 cm $\varnothing$ with 1 to several dichasia with sessile **Fl**; **Sep** linear-lanceolate, to 14 mm, margin ciliate; **Cl** tubular, to 20 $\times$ 2 mm; **Pet** fused for up to 5 mm at the base, tips spreading, white to

yellowish-cream, to 7×3.5 mm, ovate-lanceolate; **St** to 15 mm; **Anth** yellow.

C. filiformis (Ecklon & Zeyher) D. Dietrich (Synops. Pl. 2: 1032, 1840). **T:** RSA, Western Cape (Ecklon & Zeyher 1938 [BOL, K, S, SAM]). – **D:** RSA (Western Cape); Strandveld, spring-flowering. = *Grammanthes filiformis* Ecklon & Zeyher (1837) = *Dinacria filiformis* (Ecklon & Zeyher) Harvey (1862); **incl.** *Crassula capillacea* E. Meyer ex Drège (1843) (*nom. inval.*, Art. 32.1c).

[3] Erect glabrous freely branched annuals to 10 cm tall; **L** 3 - 10×2 - 4 mm, flat, lanceolate to elliptic, green to brownish, somewhat cymbiform, tip obtuse; **Inf** thyrses, often with a solitary dichasium; **Cal** lobes to 2.5 mm, oblong-triangular to broadly triangular, tips obtuse; **Cl** cup-shaped, lobes shortly fused at the base, white, oblanceolate, to 3 mm, asymmetrical and aestivation contorted (unique among the annual *Crassulaceae*), tips acute; **Anth** yellow.

C. flanaganii Schönland & Baker *fil.* (J. Bot. 36: 362, 1898). **T:** RSA, Eastern Cape (Flanagan 1272 [GRA, BOL, PRE, SAM]). – **D:** RSA (Eastern Cape, KwaZulu-Natal); rocky outcrops, autumn-flowering.

Incl. *Crassula acuminata* E. Meyer ex Drège (1844) (*nom. inval.*, Art. 32.1c).

[14] Moderately branched decumbent herbs to 20 cm tall (when flowering); **R** fibrous; **Br** wiry; **L** pairs spirally arranged, lamina 3 - 7×0.3 - 2 cm, green to yellowish-green, flat, glabrous, margins ciliate when young becoming naked, base variable from abruptly constricted to cuneate, apex acute; **Inf** terminal flat-topped thyrses with numerous dichasia; peduncle to 15 cm; **Sep** linear-triangular, to 2 mm; **Cl** tubular, to 4 mm, white tinged pink or red; **Pet** shortly fused at the base, to 3 mm, lanceolate, spreading and becoming reflexed; **Anth** yellow.

C. flava Linné (Mant. Pl., 60, 1767). **T:** LINN 400.3. – **D:** RSA (Western Cape); Fynbos, flowers mid-summer.

= *Laroechea flava* (Linné) Haworth (1812) = *Kalosanthus flava* (Linné) Sweet (1826) = *Rochea flava* (Linné) De Candolle (1828) = *Curtogyne flava* (Linné) Ecklon & Zeyher (1837) = *Sedum flavum* (Linné) Kuntze (1898); **incl.** *Crassula bullulata* Haworth (1821); **incl.** *Curtogyne burmanniana* Ecklon & Zeyher (1837) = *Crassula burmanniana* (Ecklon & Zeyher) D. Dietrich (1840); **incl.** *Crassula virgata* E. Meyer ex Drège (1843) (*nom. inval.*, Art. 32.1c); **incl.** *Sedum flavum* var. *brevifolium* Kuntze (1898); **incl.** *Sedum flavum* var. *lorifolium* Kuntze (1898).

[12] Small branched spreading herbs to 40 cm tall, older **Br** becoming $\pm$ woody, younger **Br** glabrous (but scabrid below the **Inf**); **L** 15 - 50×1 - 5

mm, glabrous, triangular-lanceolate, flat above, flat to slightly convex below, margins with rounded cilia, tips acute; **Inf** erect rounded thyrses with several dichasia; peduncle indistinct; **Sep** 3 mm, linear-lanceolate, to 6 mm, acute with marginal cilia; **Cl** cream to yellow, tubular; **Pet** fused shortly at the base, oblong-oblanceolate to -elliptic, to 9 mm, tips acute with a subterminal dorsal appendage; **Anth** brown.

C. fusca H. Herre (JSAB 19(4): 145-146, t. 21: 1-3, 1953). **T** [lecto]: RSA, Northern Cape (Herre s.n. in *SUG* 6077 [BOL]). – **D:** RSA (Northern Cape); mountain slopes, often among *Aloe pearsonii* in Succulent Karoo, flowers mid-summer.

[15] Tufted sparingly branched shrublets with **L** often in basal **Ros**, elongating and to 40 cm tall; **L** 4 - 9×0.8 - 1.5 cm, flattened, lanceolate, recurved, reddish to reddish-green, tips acute, upper face flat to concave, lower face convex, margin serrulate when young, entire when mature; **Inf** elongated rounded thyrses with several dichasia and a peduncle to 3 cm; **Fl** sessile; **Sep** lanceolate, 2 - 3 mm with marginal teeth; **Cl** tubular, whitish, lobes fused shortly at the base, lanceolate, to 5 mm; **Anth** black.

C. garibina Marloth & Schönland (Trans. Roy. Soc. South Afr. 17: 253, 1929). **T:** RSA, Northern Cape (Marloth 12507 [GRA, PRE]). – **D:** Namibia, RSA.

C. garibina ssp. *garibina* – **D:** S Namibia, RSA (Northern Cape); lower Gariep River valley, Succulent Karoo, Nama Karoo, rock crevices, spring-flowering.

[17] Erect rounded branched shrublets to 12 cm tall, older **Br** to 10 mm $\varnothing$ with brownish peeling bark, younger **Br** green, 3 - 5 mm $\varnothing$; **L** ascending and curved upwards, 15 - 35×4 - 10 mm, linear-lanceolate, flattish to subterete, upper face flat, lower face convex, epidermis grey-green, pubescent, tips acute; **Inf** round-topped to pyramidal thyrses with 1 to many stalked lax dichasia; peduncle 15 - 25 mm, pubescent with recurved **Ha**; **Bra** triangular-lanceolate, to 3 mm, clasping; **Ped** to 1 mm; **Sep** triangular, to 2 mm, acute; **Cl** to 5 mm, tubular, to 5 mm $\varnothing$ at the mouth, white to cream, lobes fused at the base, oblong-oblanceolate, acute; **Anth** yellow.

C. garibina ssp. *glabra* Tölken (JSAB 41: 106, 1975). **T:** RSA, Northern Cape (Tölken 3687 [BOL]). – **D:** RSA (Northern Cape: mountains near Steinkopf).

[17] Differs from ssp. *garibina*: Vegetative parts glabrous; **L** green to yellowish-green.

C. gemmifera H.-C. Friedrich (Mitt. Bot. Staatssamml. München 15: 592-594, fig. 7, 1979). **T:** Lesotho (*Jacot Guillarmod* 7/75 [M]). – **D:** Lesotho,

RSA (Eastern Cape, Free State, KwaZulu-Natal); moist depressions usually next to standing water in Afro-temperate grassland and mountain on tops, flowers in mid-summer.

[1] Soft erect to decumbent perennial herbs to 7 cm tall, rooting at the nodes; **R** fibrous; **L** 3 - 5 × 1 mm, spreading to recurved, linear to linear-oblongate, pale green, glabrous, upper face flat, lower face convex, tip obtuse; **Inf** reduced to a terminal **Fl** appearing axillary due to sympodial growth; **Cal** lobes to 0.5 mm, broadly triangular, tips obtuse; **Cl** cup-shaped, white, lobes to 1.5 mm, oblong-elliptic, tips recurved, subacute; **Anth** red.

The brood buds which have been name-giving are not generally characteristic and are probably only produced under extreme conditions.

C. globularioides Britten (FTA 2: 389, 1871). **T:** Malawi (*Meller* s.n. [K]). – **D:** Tanzania, Malawi.

Incl. *Crassula whyteana* Schönland (1909).

C. globularioides ssp. *globularioides* – **D:** S and C Malawi; granite rocks in grasslands, 1300 - 3000 m.

Incl. *Crassula globularioides* fa. *globularioides*; **incl.** *Crassula nyikensis* Baker fil. (1897); **incl.** *Crassula liebuschiana* Engler (1907); **incl.** *Crassula globularioides* fa. *longiciliata* R. Fernandes (1978); **incl.** *Crassula globularioides* fa. *pilosa* R. Fernandes (1978).

[17] Dwarf decumbent to erect compact rosulate and clustering low-growing herbs to 20 cm tall; **R** fibrous; **Br** to 5 mm Ø; **L** 11 - 22 × 6 - 12 mm, 4-ranked, ascending-spreading, flattened, oblong to orbicular-obovate, surface glabrous, green, tinged red under dry conditions, margin ciliate, tip obtuse; **Inf** erect thyrses with numerous globular dichasia; peduncle to 8 cm with appressed retrorse **Ha**; **Br** 2 pairs, oblong with ciliate margins, obtuse to subacute; **Ped** to 3 mm; **Sep** to 3 mm, triangular to lanceolate, ciliate; **Cl** to 5 mm, tubular, white to cream, lobes fused shortly at the base, oblong, obovate to broadly ovate-elliptical, obtuse to subacute.

The forms based on leaf characters (hairiness, length of marginal cilia) are synonymized here provisionally. *C. nyikensis* is said to differ in the smaller, thinner and more densely arranged leaves which persist on old branches, and an inflorescence that is leafy from base to apex (Fernandes 1983: 33).

C. globularioides ssp. *illichiana* (Engler) Tölken (JSAB 41: 106, 1975). **T:** Tanzania, Lushoto Distr. (*Buchwald* 174 [B, BM, K]). – **D:** Tanzania, Uganda, Malawi; highlands.

≡ *Crassula illichiana* Engler (1907).

[17] Differs from ssp. *globularioides*: **L** densely pubescent, sometimes glabrescent on the upper face; flowering stem with dense spreading papillose **Ha**, sometimes glabrescent above; **Sep** weakly keeled, keel papillose-pubescent.

C. glomerata Bergius (Descr. Pl. Cap., 85, 1767). **T:** RSA, Cape Prov. (*Grubb* s.n. [STB]). – **D:** RSA (Western Cape, Eastern Cape); Strandveld, spring-flowering; naturalized in W Australia.

≡ *Thisantha glomerata* (Bergius) Ecklon & Zeyher (1837); **incl.** *Crassula scleranthoides* Burman fil. (1768); **incl.** *Crassula glabra* Haworth (1812) ≡ *Thisantha glabra* (Haworth) Ecklon & Zeyher (1837); **incl.** *Dasystemon calycina* De Candolle (1828); **incl.** *Thisantha patens* Ecklon & Zeyher (1837) ≡ *Crassula glomerata* var. *patens* (Ecklon & Zeyher) Harvey (1862).

[2] Erect sturdy glabrous green to reddish-brown annuals to 5 cm tall; **R** fibrous; **L** 6 - 8 × 1 - 3 mm, spreading, sessile, flat, lanceolate to narrowly triangular-lanceolate, acute, upper face flat, lower face convex; **Inf** rounded thyrses with numerous sessile glomerate dichasia; **Fl** sessile, 5-merous; **Cal** lobes lanceolate, 1 - 2.5 mm, somewhat lengthening after anthesis, tips acute or obtuse; **Cl** cup-shaped, white, lobes oblong-lanceolate, to 1.5 mm, obtuse; **Anth** brown.

C. grammanthoides (Schönland) Tölken (JSAB 41: 106, 1975). **T:** RSA, Western Cape (*Schlechter* 5570 [GRA, BOL]). – **D:** RSA (Western Cape); Strandveld, spring-flowering.

≡ *Dinacria grammanthoides* Schönland (1897).

[3] Erect glabrous freely branched annuals to 5 cm tall; **L** 5 - 15 × 2 - 6 mm, flat, ovate, lanceolate to elliptic, green, somewhat cymbiform, tip obtuse; **Inf** thyrses usually with a solitary dichasium; **Cal** lobes to 2.5 mm, oblong-triangular; **Cl** cup-shaped, lobes shortly fused at the base, white or yellow, ob-lanceolate, to 5 mm, acute; **Anth** yellow.

C. granvikii Mildbraed (Notizbl. Bot. Gart. Berlin-Dahlem 8: 227, 1922). **T:** Uganda ? (*Granvik* s.n. [S]). – **D:** Uganda, Kenya, Tanzania; moist stream banks, often aquatic. **I:** Gilbert (1989: 7).

Incl. *Crassula vaillantii* var. *kilimandscharica* Engler (1907) ≡ *Tillaea vaillantii* var. *kilimandscharica* (Engler) Peter (1928); **incl.** *Tillaea repens* Peter (1928); **incl.** *Tillaea rivularis* Peter (1928) ≡ *Crassula rivularis* (Peter) Hutchinson & E. A. Bruce (1941); **incl.** *Crassula erubescens* Baker (1932); **incl.** *Crassula wrightiana* Bullock (1932).

[1] Procumbent to decumbent annuals of variable habit to 45 cm Ø, little branched and ascending in water, much branched, decumbent and rooting at the nodes and mat-forming in dry habitats; **L** 2 - 15 × 0.3 - 3.5 mm, linear to oblong-spatulate, bases of opposite **L** fused forming an almost saccate sheath to 2 mm high, tips acute to obtuse; **Inf** reduced to solitary axillary **Fl** (rarely to 4 per **Ax**); **Ped** 2 - 10 mm; **Fl** 4-merous; **Sep** oblong, to 1.3 × 1 mm, subacute to obtuse, glabrous, basally connate; **Pet** white to pink, oblong, 1 - 2 × 1 mm, tips rounded; **Anth** to 0.8 mm, reddish-purple; **Ca** obovoid, to 1.2 mm, rounded, contracted into the **Sty**; **Se** 1 - 4 per

Ca, narrowly oblong-ellipsoid, to 1 mm, minutely papillate.

Distinguished from *C. natans* by its 1 - 4 papillate seeds (1 in *C. natans*, faintly ridged).

C. grisea Schönland (Ann. South Afr. Mus. 9: 50, 1912). **T:** RSA, Northern Cape (Pearson 6054 [GRA, K]). – **D:** S Namibia, N RSA (Northern Cape); quartz and granite gravel flats and slopes, flowers mid-summer to autumn. **I:** Tölken (1985: 210, fig. 20: 4).

Incl. *Crassula bakeri* Schönland (1929); **incl.** *Crassula ihlenfeldtii* H.-C. Friedrich (1974).

[18] Erect sparingly branched shrublets with leafy stems to 15 cm tall; **Br** ± 5 mm Ø directly above the **L** and broadening to 7 mm just below the next **L**-pair; **L** triangular to triangular-lanceolate, 15 - 28 × 7 - 15 mm, grey-green, finely pubescent to glabrous; **Inf** round-topped lax thyrses to 11 cm, with several stalked dichasia; **Bra** broadly triangular, to 2 mm; **Ped** to 1 mm; **Sep** triangular, to 1.5 mm, acute, margins ciliate; **Cl** to 3 mm, tubular, lobes basally united, the obtuse tips spreading, cream; **Anth** brown.

C. marchandii H.-C. Friedrich (= *C. otzenii* hort.) might represent the hybrid between *C. grisea* and *C. plegmatoides* (Tölken 1985: 229).

C. hedbergii Wickens & Bywater (KB 34(4): 631, 1980). **T:** Ethiopia (Quartin-Dillon s.n. [P]). – **D:** Yemen, Ethiopia.

Incl. *Bulliarda abyssinica* A. Richard (1848).

[1] Similar to *C. granvikii*, but **Ped** stout and only ± 1 mm long; **Se** (4-) 6 - 7 per **Ca**, oblong, 0.83 - 0.95 × 0.25 - 0.35 mm. – [U. Eggli]

C. helmsii (Kirk) Cockayne (Trans. & Proc. New Zealand Inst. 39: 349, 1907). **T:** New Zealand (*Helms* s.n. [WELT]). – **Lit:** Jalas & al. (1999: 44). **D:** New Zealand, SE Australia incl. Tasmania; in or around standing water; introduced and weedy in W Europe (esp. England incl. Scotland). **I:** Tölken (1981: 63, fig. 2: D-F).

≡ *Tillaea helmsii* Kirk (1899); **incl.** *Tillaea curvifolia* Hooker fil. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Bulliarda recurva* Hooker fil. (1847) ≡ *Tillaea recurva* (Hooker fil.) Hooker fil. (1856) ≡ *Crassula recurva* (Hooker fil.) Ostenfeld (1918) (*nom. illeg.*, Art. 53.1).

[1] Annuals or weak perennials; **Br** decumbent, to 12 cm and much branched, floating **Br** to 25 cm; **L** oblong-lanceolate to oblong-elliptic, 3 - 8 (-12) × (0.8-) 1 - 2 (-3) mm, acute to acuminate, flattish and slightly fleshy, green to brown; **Fl** solitary in the **L** axils, 4-merous; **Ped** 4 - 7 mm in **Fr**; **Sep** triangular, 0.6 - 0.8 (-1) mm; **Cl** ± cup-shaped, white; **Pet** lanceolate, 1.6 - 2 mm, acute, spreading to ± recurved; **NSc** oblong-cuneate, truncate, white; **Se** (2-) 4 - 10 per **Ca**, smooth or with fine often incomplete longitudinal ridges. – [U. Eggli]

C. hemisphaerica Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 329, 331, 1778). **T:** RSA, Western Cape (*Thunberg* 7759 [UPS]). – **D:** RSA (Western Cape, Eastern Cape); Succulent Karoo on outcrops, usually in shade, flowers spring to mid-summer. **Fig. VII.e**

≡ *Purgosea hemisphaerica* (Thunberg) G. Don (1834); **incl.** *Crassula alooides* Aiton (1789); **incl.** *Crassula hemisphaerica* var. *foliosa* Schönland (1929); **incl.** *Crassula hemisphaerica* var. *typica* Schönland (1929) (*nom. inval.*, Art. 24.3).

[14] Dwarf solitary or sparingly branched compact perennials to 15 cm (incl. **Inf**); **L** rosulate, spreading, imbricate and recurved forming a semi-globose **Bo**, lamina 1 - 5 × 0.8 - 3 cm, ovate to elliptic, glabrous, grey-, brownish- or reddish-green, margin ciliate, tip obtuse, mucronate; **Inf** terminal erect spike-like thyrses; peduncle with short **Bra**; **Fl** pedicellate to sessile; **Sep** broadly triangular, to 1 mm, margin shortly papillate, tip rounded to obtuse; **Cl** tubular, to 3 mm, white to cream; **Pet** fused shortly at the base, oblong-ob lanceolate, to 2.8 mm, tips spreading to recurved, obtuse to acute; **Anth** black.

C. hirsuta Schönland & Baker fil. (J. Bot. 36: 365, 1898). **T:** RSA, Cape Prov. (*Schlechter* 11283 [GRA, BM, BOL, G, K, PRE, Z]). – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo, open spaces, flowers in winter and early spring.

Incl. *Crassula guilelmi-trollii* Stopp (1957).

[2] Erect annuals with stiff **Br** to 6 cm tall, moderately branched with short lateral **Br**, mostly hairy; **R** fibrous; **L** 3 - 12 × 0.5 - 2 mm, sessile, linear-triangular, cymbiform, green to reddish-brown, upper face glabrous, lower face with spreading **Ha**, margin ciliate, tip acute with a terminal stout **Ha**; **Inf** thyrses with numerous subsessile dichasia; **Fl** pedicellate, 5-merous; **Cal** lobes to 1.5 mm, broadly triangular, margin ciliate; **Cl** cup-shaped, white, lobes oblong-elliptic, obtuse; **Anth** brown.

C. hirtipes Harvey (FC 2: 361, 1862). **T:** RSA, Western Cape (*Drège* 6900 [S, P]). – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo, quartzitic sandstone rocks near the sea and inland, spring-flowering. **Fig. VII.f**

Incl. *Crassula hystrix* Schönland (1910).

[17] Small, decumbent to erect, branched, forming spreading tufts to 15 cm Ø; **R** fibrous; **L** ovate to lanceolate, 8 - 20 × 4 - 7 mm, old persistent, lamina flat, epidermis with short recurved **Ha** (rarely glabrous), green to reddish-green, upper face flat to convex, lower face markedly convex, apex obtuse or acute; **Inf** elongated thyrses with several dichasia; peduncle to 35 cm; **Sep** triangular, to 2.5 mm; **Cl** tubular, fused in the lower part, to 5 mm, yellow to cream, lobes panduriform, to 4 mm with a beak-like tip without appendage; **Anth** black to brown.

C. humbertii Descoings (Naturaliste Malgache 9(2): 189-193, ill., 1957). **T:** Madagascar (*Descoings* 2513 [TAN ?, P]). – **D:** S Madagascar; limestone crevices. **I:** KuaS 48: 199, 1997. **Fig. VII.g**

[2] Dwarf short-lived perennials 3 - 5 cm tall, branched from the base and forming small cushions; **R** fibrous; **Br** to 1.5 mm Ø, laxly papillate with distinct **Int**; **L** sessile, amplexicaul, oblong-elliptic, pointed, 6.5 - 8.5 × 2.5 - 4 mm, fleshy, to 2.5 mm thick, pale to dark green, often flushed purplish, upper face dotted with dark red, young papillate; **Fl** solitary, axillary, 5-merous, 3 - 4 mm Ø; **Ped** ± 2 mm; **Sep** 2 - 2.3 mm, basally united; **Pet** white, ± 3 mm, basally shortly united; **St** included, **Anth** yellow; **NSc** ± rectangular, ± 0.3 × 0.6 mm, yellowish-orange. – [U. Eggli]

C. hunua A. P. Druce (New Zealand J. Bot. 25: 128, 1987). **T:** New Zealand (*Cheeseman* s.n. [WELT]). – **D:** New Zealand (North Island); muddy river banks.

Incl. *Tillaea pusilla* Kirk (1899) ≡ *Crassula pusilla* (Kirk) A. P. Druce & Given (1984) (*nom. illeg.*, Art. 53.1); **incl.** *Tillaea pusilla* var. *brevia* Kirk (1899).

[1] Minute delicate herbs to 2 cm in dense cushions; stems pale green, **Int** < 5 mm; **L** (1-) 1.5 - 1.75 (-2) mm, thin, linear to linear-lanceolate, obtuse to subacute; **Fl** 4-merous, ± 1.75 mm Ø, shortly pedicellate; **Cal** deeply divided, **Sep** ovate-oblong, acute; **Pet** larger than the **Sep**, oblong to ovate-oblong, colour not described; **Sty** recurved; **Se** 2 - 4 per **Ca**. – [U. Eggli]

C. inandensis Schönland & Baker *fil.* (J. Bot. 36: 364, 1898). **T:** RSA, KwaZulu-Natal (*Wood* 764 [BM, K, SAM]). – **D:** E RSA (Eastern Cape, KwaZulu-Natal); subtropical forest, in shade, flowers in mid-summer.

≡ *Septimia inandensis* (Schönland & Baker *fil.*) P. V. Heath (1993).

[6] Decumbent herbs, sparingly branched, glabrous; **R** fibrous; **Br** 20 - 40 cm and ± 15 cm tall, rooting at the nodes, succulent, terete, to 5 mm Ø, green to reddish; **Int** 2 - 4 cm (much shorter between the 2 pairs below the **Inf**); **L** with short petioles to 4 mm (sessile below **Inf**), lamina ovate to broadly ovate, spreading, 15 - 40 × 13 - 34 mm, shiny, dark green (pale green below), margins with small undulations, crenate, tip acute to obtuse, base cuneate to truncate; **Inf** compact rounded sessile thyrses 1 cm tall; peduncle 3 - 10 mm; **Sep** 1.5 mm, oblong, obtuse, with swollen tips; **Cl** stellate, 10 mm Ø; **Pet** lanceolate, 4 × 1.5 mm, greenish-white; **Fil** 3 mm; **Anth** 1 mm, cream; **Sty** 4 mm.

C. inanis Thunberg (Prodr. Fl. Cap., 54, 1794). **T:** RSA, Cape Prov. (*Thunberg* 7762 [UPS]). – **D:** Uganda, Lesotho, RSA (Eastern Cape, E Free State, W

KwaZulu-Natal); moist depressions, usually next to permanent pools in Afro-temperate grasslands, flowers mid-summer to autumn. **I:** Tölken (1985: 106, fig. 13: 3).

≡ *Helophytum inane* (Thunberg) Ecklon & Zeyher (1837) ≡ *Tillaea inanis* (Thunberg) Steudel (1841); **incl.** *Tillaea perfoliata* Linné *fil.* (1782) ≡ *Bulliarda perfoliata* (Linné *fil.*) De Candolle (1801); **incl.** *Helophytum inane* var. *latifolium* Ecklon & Zeyher (1837) ≡ *Tillaea perfoliata* var. *latifolia* (Ecklon & Zeyher) Walpers (1843).

[1] Soft erect to decumbent sparingly branched perennial aquatic herbs to 30 cm tall; **R** stock rhizomatous; **L** 8 - 20 × 2 - 5 mm, lanceolate to triangular, flat, slightly succulent, green, glabrous, tips obtuse; **Inf** thyrses with sessile dichasia ending in axillary monochasia due to sympodial growth; **Sep** to 0.5 mm, broadly triangular; **Cl** cup-shaped, white, lobes to 2.5 mm, obovate, tips recurved, obtuse; **Anth** yellow to purple.

C. intermedia Schönland (Trans. Roy. Soc. South Afr. 17: 244, 1929). **T:** GRA. – **D:** RSA (Eastern Cape); in shade of thickets, spring-flowering.

[14] Rosulate, usually proliferating from the base to form dense groups to 6 cm tall (excl. **Inf**); **R** fibrous; **L** 20 - 50 × 13 - 25 mm, flat, obovate to oblong-obovate, upper **L** ascending and tightly imbricate forming a hollow cup, lower **L** spreading and not imbricate, all grey-green, glabrous, margins ciliate, tip acute to obtuse; **Inf** terminal elongate to round-topped thyrses with numerous clustered dichasia; peduncle to 15 cm; **Sep** to 1.5 mm, ovate, ciliate; **Cl** tubular, to 3 mm; **Pet** oblong-obovate, to 2.5 mm, fused shortly at the base, white, sometimes tinged reddish, tips rounded; **Anth** yellow.

C. ×justi-corderoyi hort. ex H. Jacobsen & von Poellnitz (*pro sp.*) (Jahrb. Deutsche Kakt.-Ges. 1: 131-133, 1936). **T:** not preserved?. – **I:** Jacobsen (1933: 45).

Perennials with clustering **Ros**; **L** to 2.2 × 1 cm, lanceolate, fleshy, flat above, rounded below, dark green with red spots and short dense **Ha** arranged in indistinct longitudinal rows; **Fl** reddish.

Most probably a hybrid involving *C. falcata*.

C. kirkii (Allan) A. P. Druce & Given (New Zealand J. Bot. 22(4): 583, 1984). **T:** New Zealand (*Kirk* 935 [WELT]). – **D:** New Zealand (N shores of Cook Strait).

≡ *Tillaea kirkii* Allan (1961); **incl.** *Tillaea diffusa* Kirk (1892) (*nom. illeg.*, Art. 53.1) ≡ *Crassula diffusa* (Kirk) Cockayne (1909) (*nom. illeg.*, Art. 53.1).

[1] Small herbs to 8 cm in dense cushions; **Br** ± slender, erect or prostrate, filiform, sparingly branched, **Int** 5 - 10 mm; **L** 2 - 3.5 mm, fleshy, very narrowly oblong, obtuse, minutely apiculate; **Fl** 4-merous, 1.5 - 1.75 mm Ø; **Ped** 1 mm; **Cal** minute; **Sep** broadly ovate to ovate-oblong, obtuse; **Pet** as

long or slightly longer than the **Sep**, broadly oblong, obtuse, colour not recorded; **Se** 2 - 4 per **Ca**. – [U. Eggli]

C. lactea Aiton (Hort. Kew. 1: 396, 1789). **T**: RSA, Western Cape (*Masson* s.n. [BM]). – **D**: RSA (Eastern Cape, Western Cape); subtropical thickets in sun or shade, flowers mid-winter to early spring.

≡ *Toelkenia lactea* (Aiton) P. V. Heath (1993).

[6] Decumbent to erect, 10 - 20 cm tall, branched from the base to form dense groups; **R** fibrous; **Br** 8 - 10 mm Ø, grey, bark peeling, dark brown; **L** sessile, ovate, flat, 3 - 6 × 2.3 - 3.6 cm, ascending-spreading, glaucous, margins entire, acute with conspicuous hydathodes, basally decurrent and somewhat united with the opposite **L**, base cuneate, tip acute; **Inf** ascending pyramidal thyrses 10 - 19 cm tall with numerous dichasia (up to 7 nodes); lower **Bra** 15 × 10 mm, triangular-ovate, concave; **Ped** 3 - 4 mm; **Sep** linear, 1 mm; **Cl** stellate, 14 - 15 mm Ø; **Pet** 6 - 7 × 1.5 - 2 mm, white; **Fil** 4 - 5 mm.

C. lanceolata (Ecklon & Zeyher) Endlicher *ex* Walpers (Repert. Bot. Syst. 2: 254, 1843). **T**: RSA, Cape Prov. (*Ecklon & Zeyher* 1874 [S, W]). – **D**: S Africa.

≡ *Tetraphyle lanceolata* Ecklon & Zeyher (1837) ≡ *Crassula schimperi* var. *lanceolata* (Ecklon & Zeyher) Tölken (1975) (*nom. nud.*) ≡ *Combesia lanceolata* (Ecklon & Zeyher) P. V. Heath (1993).

C. lanceolata ssp. *denticulata* (Brenan) Tölken (in Leistner & al. (ed.), Fl. South Afr. 14: 115, 1985). **T**: Malawi (*Brass* 16784 [K, BR]). – **D**: S Malawi, RSA (Northern Prov.). **Fig. VII.h**

≡ *Crassula pentandra* var. *denticulata* Brenan (1954) ≡ *Crassula schimperi* var. *denticulata* (Brenan) R. Fernandes (1978) ≡ *Combesia lanceolata* ssp. *denticulata* (Brenan) P. V. Heath (1993).

[2] Differs from ssp. *lanceolata*: **R** and main **Br** fleshy; **L** lanceolate and longer, to 2× as long as the axillary cymules, margin denticulate, tip ending in a colourless awn; **Cal** lobes to 1.8 mm, sharply acute.

C. lanceolata ssp. *lanceolata* – **D**: RSA (Western Cape, Eastern Cape, Gauteng, Mpumalanga, Northern Prov., KwaZulu-Natal, Free State), Lesotho; rocks and rock crevices in grassland, Fynbos and Bushveld, flowers mid-summer to mid-winter.

Incl. *Tillaea subulata* var. *illecebroides* Welwitsch *ex* Hiern (1896) ≡ *Crassula schimperi* var. *illecebroides* (Welwitsch *ex* Hiern) G. D. Rowley (1978); **incl.** *Crassula filamentosa* Schönland (1917) ≡ *Crassula schimperi* fa. *filamentosa* (Schönland) R. Fernandes (1978).

[2] Decumbent perennials to 10 cm tall with filiform **Br** rooting at the nodes and freely branching from the base forming small groups or mats; **L** 4 - 6

× 1.5 - 3 mm, flat, triangular-lanceolate, ± as long or 2× as long as the axillary cymules, green to grey-green, ± papillose towards the acute tips (tips without terminal colourless point); **Inf** thyrses with sessile axillary dichasia; **Fl** sessile, 5-merous; **Cal** lobes linear-triangular, to 1.5 mm, acute, as long or longer than the **Cl** lobes; **Cl** cup-shaped, yellowish-green, lobes linear-triangular, to 1 mm, acute; **Anth** yellow.

Common in rocky areas, esp. in shady rock crevices, occurring in Fynbos or Renosterveld. Occasionally cultivated as ground cover.

C. lanceolata ssp. *transvaalensis* (Kuntze) Tölken (in Leistner & al. (ed.), Fl. South Afr. 14: 115, 1985). **T**: RSA, Transvaal (*Kuntze* s.n. [NY, K]). – **D**: Namibia, N and E RSA, Swaziland, Lesotho, Malawi, Moçambique, Zimbabwe, Angola; rock outcrops in grassland, flowers mid-summer to autumn. **I**: Fernandes (1983: 9, as *C. schimperi* ssp. *transvaalensis*). **Fig. VIII.a**

≡ *Sedum transvaalense* Kuntze (1898) ≡ *Crassula transvaalensis* (Kuntze) K. Schumann (1900) ≡ *Crassula schimperi* fa. *transvaalensis* (Kuntze) R. Fernandes (1978) ≡ *Crassula schimperi* ssp. *transvaalensis* (Kuntze) R. Fernandes (1978) ≡ *Crassula schimperi* var. *transvaalensis* (Kuntze) R. Fernandes (1978) ≡ *Combesia lanceolata* ssp. *transvaalensis* (Kuntze) P. V. Heath (1993) ≡ *Tillaea schimperi* ssp. *transvaalensis* (Kuntze) M. G. Gilbert & al. (2000); **incl.** *Thisantha subulata* Hooker *fil.* (1843) ≡ *Tillaea subulata* (Hooker *fil.*) Britten (1871); **incl.** *Crassula selago* Dinter (1919).

[2] Differs from ssp. *lanceolata*: **R** fleshy; **Br** erectly fastigiate, ± deciduous, not rooting at the nodes; **L** usually deciduous towards the dry season, 2 - 4 × as long as the axillary cymules, tips acute with colourless points; **Sep** to 1.5 mm, acute.

C. lanuginosa Harvey (FC 2: 347, 1862). **T**: RSA, Eastern Cape (*Drège* s.n. [S, E, G, K, LE, P, TCD]). – **D**: RSA.

C. lanuginosa var. *lanuginosa* – **D**: RSA (Eastern Cape); grasslands and thickets, in shade, flowers from mid-summer to autumn.

Incl. *Crassula strigosa* E. Meyer *ex* Drège (1843) (*nom. nud.*).

[17] Densely branched decumbent to prostrate mat-forming herbs to 5 cm tall and 20 cm Ø; **R** fibrous; **Br** ± 1 mm Ø, hairy, sometimes with aerial **R**; **Int** on the short lateral **Br** hidden by the densely arranged **L**; **L** 2 - 10 × 1 - 4.5 mm, elliptic to obovate, spreading-ascending, flattish but both faces convex, lamina with spreading **Ha**, tip acute with long cilia; **Inf** thyrses to 15 × 5 mm with 3 - 7 **Fl** usually subtended with 1 pair of **Bra**; peduncle 3 - 15 mm; **Sep** triangular-oblong, 1 × 0.3 mm; **Cl** to 3 mm, tubular, lobes fused at the base, lorate-obovate, tips recurved with a dorsal appendage; **Anth** black.

C. lanuginosa var. **pachystemon** (Schönland & Baker *fil.*) Tölken (JSAB 41: 106-107, 1975). **T** [lec-tol]: RSA, Eastern Cape (*Bolus* 437 [GRA, BOL, K, PRE]). – **D**: RSA (Eastern Cape); rock outcrops in grassland.

≡ *Crassula pachystemon* Schönland & Baker *fil.* (1898); **incl.** *Crassula ernestii* Schönland & Baker *fil.* (1902).

[17] Differs from var. *lanuginosa*: Plants larger; **Int** usually visible; **L** elliptic, obovate to linear-obovate, 8 - 30 × 4 - 10 mm, flat, upper face flat to convex, lower face convex, lamina with recurved somewhat appressed **Ha**, tip obtuse; **Inf** with up to 15 sessile **Fl**; **Cl** to 4 mm.

C. lasiantha Drège *ex* Harvey (FC 2: 344, 1862). **T**: RSA, Western Cape (*Drège* s.n. [TCD, BM, E, G, K, LE, P, PRE, S, SAM]). – **D**: RSA (Western Cape); Fynbos, shady rocky cliffs, flowers mid-summer to autumn.

[11] Perennial mat-forming branched herbs with persistent **L**; **R** fibrous; **Br** prostrate, wiry, rooting at the nodes, young **Br** with recurved **Ha**; **L** obovate-elliptic to circular, 3 - 6 × 3 - 4 mm, subdistichous, flat, glabrous, green, becoming reddish in the dry season, margin ciliate, tips obtuse; **Inf** thyrses with several dichasia; peduncle indistinct; **Sep** to 2 mm, oblong-triangular, hairy, margin ciliate, tips obtuse; **Cl** tubular, white to cream; **Pet** oblanceolate-elliptic, to 3.5 mm, shortly fused at the base, tips acute with subterminal apical appendage; **Anth** yellow.

C. latibracteata Tölken (JSAB 41: 107-108, 1975). **T**: RSA, Eastern Cape (*Tölken* 4344 [BOL]). – **D**: RSA (Eastern Cape); Valley Bushveld and grassland, among rocks, flowers mid-summer to autumn. **I**: Tölken (1985: 217, fig. 21: 2).

≡ *Globulea latibracteata* (Tölken) P. V. Heath (1995).

[20] Dwarf branched decumbent to erect pubescent herbs to 40 cm tall forming small groups; **R** fibrous; **Br** succulent, green to reddish-green, becoming woody and grey-brown; old **L** not persistent; **L** 8 - 25 × 4 - 7 mm, flattened, spreading, obovate, falcate and often twisted sideways, pubescent to glabrous, both faces flat to slightly convex, green to yellowish-green, margin acute, base cuneate, tip obtuse to rounded; **Inf** capitate thyrses to 25 cm with 1 - 3 globular dichasia; upper **Bra** large, obovate-spaulate, covering the **Inf** base; **Sep** oblong-triangular, to 2.5 mm, obtuse; **Cl** tubular, cream, lobes oblong, to 3.5 mm, fused shortly at the base and with linear ellipsoid apical appendages.

C. leachii R. Fernandes (Bol. Soc. Brot., sér. 2, 55: 95, 1982). **T**: Moçambique (*Leach* 8135 [PRE, M, SRGH]). – **D**: Moçambique; Bushveld, on granite rocks.

[17] Decumbent low growing herbs to 23 cm; **R**

fibrous; **Br** slightly woody towards the base, hairy; **L** 12 - 22 × 2.5 - 9 mm, sessile, ascending, oblong to elliptic, flattened, lamina hairy, grey-green, margin entire, base cuneate, tip obtuse; **Inf** erect thyrses with numerous glomerate dichasia to 28 mm Ø, peduncle to 8 cm with 2 - 3 pairs of oblong **Bra** to 5 mm; **Fl** (sub-) sessile; **Sep** triangular to ovate, to 2 mm; **Cl** white, campanulate, to 4 mm, lobes oblong to obovate-oblong, to 3.25 mm, obtuse; **Anth** purple.

C. longipes (Rose) Bywater & Wickens (KB 39(4): 712, *ills.* (p. 711), 1984). **T**: Mexico, Hidalgo (*Pringle* 13407 [US 401957]). – **D**: SE USA (Florida, Louisiana, Texas), Mexico, Paraguay, Argentina; wet places to half-submerged on river ledges.

≡ *Tillaeastrum longipes* Rose (1911) ≡ *Tillaea longipes* (Rose) J. Meyrán (1993).

[1] Erect herbs to 2.5 cm; **L** lanceolate to oblanceolate, (0.3-) 2 - ± 5 mm, acute to obtuse; **Fl** 1 per node, 4-merous; **Ped** ± 1.5 - 3 (-8) mm; **Sep** ± triangular, 0.4 - 0.7 × 0.3 - 0.6 mm, obtuse; **Pet** triangular, 1.1 - 1.7 × 0.4 - 0.6 mm, acute, longer than the **Sep**; **NSc** filiform, 0.4 mm; **Se** 12 - 14 per **Ca**, oblong, ± 0.25 - 0.32 × 0.15 mm, reddish-brown, slightly ridged.

Commonly confused with *C. drummondii* (Bywater & Wickens 1984: 714). – [U. Eggli]

C. luederitzii Schönland (Trans. Roy. Soc. South Afr. 17: 253, 1929). **T**: Namibia (*Stöber* s.n. in *Marloth* 11918 [PRE]). – **D**: S Namibia; Succulent Karoo, in the shade of rocks, flowers mid-winter to spring.

[14] Rosulate, usually proliferating from the base to form small groups to 15 cm tall (**incl.** **Inf**); **R** fibrous; **L** 10 - 30 × 8 - 20 mm, 4-ranked, flat, oblong-oblanceolate, green to reddish, spotted, glabrous, margins ciliate, tip acute; **Inf** terminal round-topped thyrses with numerous dichasia; **Bra** **L**-like, becoming smaller upwards; **Sep** to 2 mm, oblong-triangular; **Cl** white, tubular, 4 mm; **Pet** oblong, to 3 mm, fused shortly at the base; **Anth** black.

C. macowaniana Schönland & Baker *fil.* (J. Bot. 36: 361, 1899). – **D**: S Namibia, RSA (Northern Cape); Succulent Karoo, flowers summer to autumn. **I**: Tölken (1985: 194, fig. 18: 4).

Incl. *Rochea perfoliata* var. *glaberrima* E. Meyer *ex* Drège (1844) (*nom. inval.*, Art. 32.1c); **incl.** *Crassula macowaniana* var. *crassifolia* Schönland (1912).

[15] Rounded much-branched shrubs to 1.2 m tall; older **Br** woody with reddish-brown to grey peeling bark; younger **Br** terete, 6 - 7 mm Ø; **L** 35 - 55 × 7 - 18 mm, variable in shape, triangular-lanceolate to linear-lanceolate, flattened to subterete, green to grey-green, sometimes reddish or with a reddish margin, often with powdery bloom, upper face flat to convex, lower face convex, tip acute;

Inf terminal rounded thyrses; peduncle 3.5 - 5 cm; lower **Bra** erect, reddish, linear-lanceolate, 10 mm; **Ped** 1 - 2 mm; **Sep** linear, 1 mm; **Cl** stellate, to 7 mm $\varnothing$ with short tube, lobes shortly fused, white or pink, 2.5 - 4 $\times$ 1.8 mm, oblanceolate, tips slightly recurved.

C. manaia A. P. Druce & W. R. Sykes (New Zealand J. Bot. 26(3): 477-478, ill., 1988). **T:** New Zealand (Druce s.n. [CHR 179637]). – **D:** New Zealand (W and S Taranaki); near coasts.

[1] Small delicate annual or perennial herbs forming dense moss-like mats, to 1 cm tall; main stem filiform, colourless or pale pink, rooting below; **L** 1 - 2 (-3.5) $\times$ 0.6 - 1 mm, broadly elliptic-ovate, minutely densely papillose, spreading-ascending; **Fl** solitary in the **L** axils, 4-merous, 1 - 1.3 mm $\varnothing$; **Ped** < 1 mm, elongating to 3 mm in **Fr**; **Pet** triangular-ovate, shorter or longer than the **Sep**, red-tipped; **Se** 1 - 2 per **Ca**, 0.3 - 0.35 mm, brown, $\pm$ cylindrical-ellipsoid.

Compared with *C. mataikona* in the protologue. – [U. Eggli]

C. mataikona A. P. Druce (New Zealand J. Bot. 25: 128, 1987). **T:** New Zealand, North Island (*Colenso* s.n. [K?]). – **D:** New Zealand.

Incl. *Tillaea debilis* Hooker fil. (1852) $\equiv$ *Crassula debilis* (Hooker fil.) A. P. Druce & Given (1984) (*nom. illeg.*, Art. 53.1).

[1] Weak slender herbs; stems 5 - 7.5 cm, not or sparingly branched; **L** in remote pairs, 2.1 - 4.2 mm, basally connate, ovate-oblong or linear; **Fl** few, sessile or pedicellate, very minute, 4-merous; **Sep** ovate, acute; **Pet** shorter than the **Sep**, ovate, acuminate, colour not described; **Se** 1 - 2 per **Ca**.

Only known from few specimens and compared with *Tillaea verticillaris* (= *Crassula sieberiana*) in the original description. – [U. Eggli]

C. mesembrianthemopsis Dinter (RSN 19(8-10): 143-144, 1923). **T:** Namibia (Dinter 4685 [B]). – **D:** S Namibia, N RSA (Northern Prov.); quartz gravel flats, autumn-flowering.

[17] Dwarf, rosulate, **L** spirally arranged, growing sunken in nature with only the upper **L** margin exposed, old **L** persistent; **L** 10 - 20 $\times$ 3 - 6 mm, flat, cuneate, epidermis papillate (less so towards the base), grey-green, upper face flat, lower face convex, apex truncate; **Inf** rounded compact dichasia partly hidden by the upper **L**; peduncle to 2 cm with recurved fine **Ha**; **Ped** short; **Sep** to 3.5 mm, oblong-triangular, sparingly hairy, margin ciliate; **Cl** tubular, to 7 mm, white to cream, lobes fused shortly at the base, oblong, tips slightly hooded and with indistinct dorsal appendage; **Anth** yellow.

C. mesembryanthoides (Haworth) D. Dietrich (Synops. Pl. 2: 1031, 1840). **T:** K [lecto: unpubl. pl. 763]. – **D:** RSA.

$\equiv$ *Globulea mesembryanthoides* Haworth (1824).

C. mesembryanthoides ssp. **hispida** (Haworth) Tölken (JSAB 41: 108, 1975). **T:** K [lecto: unpubl. pl. 762]. – **D:** RSA (Eastern Cape); Valley Bushveld, flowers mid-summer to autumn.

$\equiv$ *Globulea hispida* Haworth (1825) $\equiv$ *Crassula hispida* (Haworth) D. Dietrich (1840) $\equiv$ *Globulea mesembryanthoides* var. *hispida* (Haworth) P. V. Heath (1995); **incl.** *Sphaeritis paucifolia* Ecklon & Zeyher (1837).

[20] Differs from ssp. *mesembryanthoides*: **Int** shorter, to 5 mm; **L** erect, linear-lanceolate, 2 - 5 cm, covered with slightly recurved softer **Ha**.

C. mesembryanthoides ssp. **mesembryanthoides** – **D:** RSA (Eastern Cape); Karoo and Valley Bushveld, flowers autumn and winter.

Incl. *Sphaeritis trachysantha* Ecklon & Zeyher (1837) $\equiv$ *Crassula trachysantha* (Ecklon & Zeyher) Harvey (1862).

[20] Erect branched pubescent herbs to 40 cm tall forming small groups; **R** fibrous; **Br** succulent, green, older **Br** becoming woody and reddish-brown; **Int** 5 - 20 mm, all $\pm$ of the same length; old **L** not persistent; **L** 10 - 20 $\times$ 2 - 4 mm, flattened, ascending, linear-elliptic, green to yellowish-green, covered with dense recurved **Ha**, upper face flat to convex, lower face convex, base cuneate, tip acute; **Inf** globose to flattened thyrses to 30 cm with several dichasia; **Sep** linear-triangular, to 3.5 mm, acute; **Cl** tubular, cream, lobes linear-panduriform, to 4.5 mm, fused shortly at the base, with linear-ellipsoid apical appendages appressed to each other; **Anth** black.

C. micans Vahl ex Baillon (Bull. Mens. Soc. Linn. Paris 1(59): 469-470, 1885). **T:** Madagascar (*Commerçon* s.n. [P-JU, PJ]). – **Lit:** Allorge-Boiteau (2002: with ill.). **D:** SE Madagascar (region of Tolanaro); coastal sands.

[?] Small perennial prostrate herbs with slender delicate stems; **L** crowded towards the stem tips, lanceolate, $\pm$ 13 $\times$ 7 mm, petiolate, margins of the lamina with purple spots; **Inf** few-flowered or **Fl** solitary; **Fl** 5-merous, pedicellate; **Sep** lanceolate, green; **Pet** lanceolate, rotately spreading, pale pinkish; **Fil** white; **Ca** white.

Only recently recollected and still insufficiently known. – [U. Eggli]

C. minuta Tölken (JSAB 41: 108-109, 1975). **T:** RSA, Cape Prov. (*Esterhuysen* 12233 [BOL, K, PRE]). – **D:** RSA (Western Cape, Northern Cape); in shallow rock pans, spring-flowering.

[2] Erect annuals with wiry **Br** to 3 cm tall; **R** fibrous; **L** 1 - 3 $\times$ 0.5 - 1 mm, sessile, linear-elliptic, glabrous, green to reddish-brown, upper face flat, lower face convex, tip obtuse; **Inf** thyrses with numerous dichasia; **Fl** pedicellate, 4-merous; **Cal**

lobes to 1.5 mm, elliptic-lanceolate, subacute; **Cl** cup-shaped, white to cream; **Anth** yellow (?).

C. minutissima (Skottsberg) Bywater & Wickens (KB 39(4): 711, ill., 1984). **T:** Argentina, Santa Cruz (Skottsberg 710 [UPS, BA, S, SGO]). – **D:** S Argentina (Patagonia); damp places, known from the type only.

≡ *Tillaea minutissima* Skottsberg (1916).

[1] Diminutive erect herbs to 1.5 cm; **L** lanceolate, 2 - 3.5 mm, acute; **Fl** 1 per node, 4-merous; **Ped** ± 0.2 mm; **Sep** triangular, obtuse, 0.3 - 0.4 mm; **Pet** ovate, 0.8 × 0.4 mm; **NSc** filiform, 0.4 mm; **Se** 2 per **Ca**, oblong, 0.58 × 0.23 mm, reddish-brown, longitudinally striate to ridged.

Differs from *C. aquatica* and *C. saginoides* by its small size and large seeds. – [U. Eggli]

C. mollis Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 330, 340, 1778). **T:** RSA, Eastern Cape (Thunberg 7766 [UPS, G, SJ]). – **D:** RSA (Western Cape, Eastern Cape); Succulent Karoo and thickets, flowers in mid-summer.

≡ *Globulea mollis* (Thunberg) Haworth ex De Candolle (1828); **incl.** *Globulea subincana* Haworth (1824) ≡ *Crassula subincana* (Haworth) D. Dietrich (1840); **incl.** *Globulea subincana* var. *decumbens* Haworth (1824); **incl.** *Globulea subincana* var. *erecta* Haworth (1824); **incl.** *Sphaeritis margaritifera* Ecklon & Zeyher (1837) ≡ *Crassula margaritifera* (Ecklon & Zeyher) Harvey (1862).

[20] Erect to decumbent much-branched shrublets to 50 cm tall; **Br** basally woody, to 4 mm Ø, grey to reddish-green with dark reddish-brown bark becoming smooth; young **Br** green, 1.5 mm Ø, velvety; **L** spreading-ascending, 15 - 20 × 2 - 5 mm, linear-lanceolate to linear-elliptic, upper face convex to flat, lower face convex, tips acute; **Inf** erect round-topped thyrses to 20 cm with 3 to many dense glomerate dichasia to 12 mm Ø; peduncle to 14 cm with up to 6 pairs of **L**-like **Bra**, hairy; **Ped** to 1 mm or **Fl** sessile; **Sep** oblong, fleshy, obtuse; **Cl** to 3 mm long, tubular, white to cream, lobes fused shortly at the base, panduriform with hooded tips and dorsal appendages; **Anth** black.

C. montana Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 329, 332, 1778). **T:** RSA, Western Cape (Thunberg 7767 [UPS, G-DC, LINN, SJ]). – **D:** RSA.

≡ *Purgosea montana* (Thunberg) G. Don (1834).

C. montana ssp. *montana* – **D:** RSA (Western Cape); Succulent and Nama Karoo, spring-flowering. **Fig. VIII.c**

Incl. *Crassula engleri* Schönland (1907).

[14] Rosulate, usually proliferating from the base to form small dense groups to 3 cm tall (excl. **Inf**); **R** fibrous; **L** 15 - 25 × 10 - 16 mm, ovate to broadly obovate, flat, in dense basal **Ros**, becoming smaller

upwards, light to dark green with dark green dots, glabrous but with short marginal cilia, tip acute to obtuse; **Inf** terminal spike-like thyrses (occasionally flat-topped) 5 - 9 cm with sessile dichasia; peduncle 1 - 8 cm; **Bra** **L**-like, obovate to lanceolate, 5 - 14 × 6 - 8 mm, ciliate; **Sep** 2 - 4 mm, triangular-lanceolate, ciliate; **Cl** tubular, 6 mm; **Pet** oblong, white, 5 mm, fused shortly at the base, tips spreading.

C. montana ssp. *quadrangularis* (Schönland) Tölken (JSAB 41: 109, 1975). **T:** RSA, Western Cape (Marloth 2512 [GRA]). – **D:** RSA (N Western Cape); in shade of rocks, spring-flowering.

≡ *Crassula quadrangularis* Schönland (1903); **incl.** *Crassula gillii* Schönland (1907).

[14] Differs from ssp. *montana*: **Br** smaller, forming dense mats; **L** 7 - 8 × 8 - 12 mm, obovate, neatly decussate and appressed forming a truncate square **Bo** 2 × 2 cm; **Inf** erect flat-topped to rounded thyrses to 5 cm; peduncle 3 cm; **Bra** ovate, 4 mm; **Cl** tubular; **Pet** basally fused, apically spreading star-like, white, 5 mm.

C. morrumbalensis R. Fernandes (Bol. Soc. Brot., sér. 2, 55: 97, 1982). **T:** Moçambique (Torre 4551 [LISC]). – **D:** Moçambique; rock outcrops in savanna at the type locality.

[17] Decumbent to procumbent low-growing herbs; **R** fibrous; main **Br** procumbent, to 4 mm Ø, rooting at the nodes, with erect side **Br** to 5 cm tall with 4-angled stems, sometimes with basal **Ros**, bark basally dark brown, papery, reddish-brown upwards; **L** 13 - 24 × 5 - 7 mm, usually rosulate, flattened, base attenuate, lamina oblong-elliptic to elliptic, glabrous, margin acute, ciliate, tip acute to subacute; **Inf** erect thyrses with numerous dichasia to 2 cm Ø; peduncle towards the tip with appressed **Ha**; **Bra** 2 pairs, oblong with ciliate margins; **Sep** to 2.5 mm, triangular to lanceolate, ciliate; **Cl** stellate, to 10 mm Ø, white, lobes oblong-obovate, obtuse.

C. moschata G. Forster (Commentat. Soc. Regiae Sci. Gott. 9: 26, 1787). **T:** Tierra del Fuego, Isla de los Estados (Forster s.n. [BM, AD [photo], LE, LECB, MW]). – **D:** S Argentina, S Chile, several antarctic islands, Australia (Tasmania), New Zealand; rock crevices just above the high-water mark. **I:** Bywater & Wickens (1984: 705, fig. 1: A-E).

≡ *Bulliarda moschata* (G. Forster) D'Urville (1825) ≡ *Tillaea moschata* (G. Forster) De Candolle (1828); **incl.** *Bulliarda magellanica* De Candolle (1801) (*nom. inval.*, Art. 32.1c); **incl.** *Tillaea magellanica* Willdenow ex Schultes (1827) ≡ *Crassula magellanica* (Willdenow ex Schultes) Macloskie (1905); **incl.** *Tillaea chilensis* Gay (1846); **incl.** *Tillaea litoralis* Philippi ex Rossow (1983) (*nom. inval.*, Art. 34.1a).

[1] Erect leafy reddish annual herbs to 5 (-15) cm; **Br** to 1 mm Ø, prostrate; **L** elliptic to obovate or spatulate, (2.4-) 3.3 - 5 mm, lower face often

with conspicuous round glandular dots; **Fl** 1 per node, 4-merous; **Ped** 2 - 3 mm; **Sep** triangular, obtuse, 1.5 - 1.7 × 0.9 - 1 mm, outside with glandular dots; **Cl** cup-shaped, white; **Pet** oblong-lanceolate, 2 - 2.3 × 1 mm, longer than the **Sep**; **NSc** oblong, 1 × 0.5 mm, rounded; **Se** 2 - 4 (-8) per **Ca**, oblong-ellipsoid, 0.7 × 0.35 - 0.44 mm Ø, reddish-brown, not ridged, minutely rugulose.

This is the largest S American species of this group and the plants are rather sturdy. – [U. Eggli]

C. multicaulis (Petrie) A. P. Druce & Given (New Zealand J. Bot. 22(4): 583, 1984). **T**: New Zealand (Petrie s.n. [WELT]). – **D**: New Zealand; local, montane damp grassland and wet places.

≡ *Tillaea multicaulis* Petrie (1887).

[1] Small herbs to 3 cm tall in ± open patches; stems prostrate, rooting at the nodes with ascending tips; **Int** to 1 cm, mostly shorter; **L** ± 2 mm, fleshy, ovate-subulate, acute, ± apiculate, ± imbricate on short **Br**; **Fl** 4-merous, 2.5 - 3.5 mm Ø, shortly pedicellate; **Cal** divided for ± ½; **Sep** broadly subulate, acute; **Pet** 2× as long as the **Sep**, rose to white, broadly oblong, obtuse; **Sty** slender, recurved; **Se** 8 per **Ca**. – [U. Eggli]

C. multicava Lemaire (Rev. Hort. 1862: 97, 1862). **T** [neo]: RSA, Eastern Cape (Flanagan 161 [BOL, GRA, SAM]). – **D**: RSA.

≡ *Septimia multicava* (Lemaire) P. V. Heath (1993).

C. multicava ssp. **floribunda** H.-C. Friedrich ex Tölken (JSAB 41: 109-110, 1975). **T**: RSA, KwaZulu-Natal (Strey 4209 [PRE, NH]). – **D**: RSA (KwaZulu-Natal); coastal forest and valleys.

[6] Differs from ssp. *multicava*: Stems taller, often erect, branched, to 30 cm; **L** often hairy; **Inf** with oblong obtuse **Bra**.

C. multicava ssp. **multicava** – **D**: RSA (Eastern Cape, KwaZulu-Natal); coastal forest and savanna, flowers late winter to spring.

Incl. *Crassula quadrifida* Baker fil. (1873).

[6] Decumbent to erect, 10 - 20 cm tall (excl. **Inf**), branched from the base to form dense groups; **R** fibrous; **Br** 5 - 10 mm Ø, green; **L** shortly petiolate to 15 mm, lamina green (rarely lower face purplish), ovate, flat, 3 - 6 × 2.8 - 4.8 cm, ascending-spreading, margins entire, acute with conspicuous hydathodes, base cuneate to cordate, tip acute; **Inf** ascending pyramidal thyrses 18 - 22 cm tall with numerous dichasia (up to 5 nodes); peduncle to 12 cm; **Ped** 3 - 8 mm; **Sep** linear, 1.5 mm; **Cl** 4- or 5-merous, stellate, 10 mm Ø; **Pet** 5 × 2 mm, white to light pink; **Fil** 2 mm.

C. multiceps Harvey (FC 2: 359, 1862). **T**: RSA, Western Cape (Zeyher 660 [S, BM, E, FI, G, K, LE, P, SAM]). – **D**: RSA (Northern Cape, Western

Cape); Succulent Karoo, hill-tops, flowers in mid-winter. **Fig. VIII.d**

≡ *Tetraphyle multiceps* (Harvey) P. V. Heath (1993).

[16] Ascending, rounded, much branched, dwarf, to 4 cm tall and 6 cm Ø, usually from a single main stem to 4 mm Ø; **R** fleshy, horizontal, to 4 mm Ø; main stem grey-brown with peeling bark; younger **Br** 1 mm Ø; **L** in whorls of 4 - 7 and fused at their bases, ascending, incurved, 4 - 6 × 1 - 1.5 mm, flat, green to brownish-green, triangular-lanceolate, leathery becoming revolute during summer, margin entire, tip acute; dead **L** persistent, brown; **Inf** terminal cymose capitula; **Sep** to 3 mm, oblong-oblan-ceolate, with few cilia at the base; **Cl** tubular, to 10 mm, ampulliform, lobes cream to pale yellow, elliptic-oblong, fused in lower 2 mm; **Anth** yellow.

The whorled leaves are a unique feature in the genus.

C. multiflora Schönland & Baker fil. (J. Bot. 36: 338, 1898). **T**: RSA, Western Cape (Bolus 6702 [GRA, BOL, K]). – **D**: RSA.

C. multiflora ssp. **leucantha** (Schönland & Baker fil.) Tölken (JSAB 41: 110, 1975). **T**: RSA, Western Cape (Schlechter 7378 [GRA, BM, BOL, G, K, P, Z]). – **D**: RSA (Western Cape); mountainous Fynbos, acid soil on quartzitic sandstone, flowers mid-summer.

≡ *Crassula leucantha* Schönland & Baker fil. (1898).

[11] Differs from ssp. *multiflora*: **L** oblanceolate, to 25 mm; **Inf** rounded thyrses to 3 cm Ø; **Pet** oblong-elliptic.

C. multiflora ssp. **multiflora** – **D**: RSA (Western Cape); mountainous Fynbos and Renosterveld, acid soil on quartzitic sandstone, flowers mid-summer.

[11] Erect branched rounded subshrubs or shrubs to 1.2 m tall; **R** fibrous; **Br** woody at the base, brown, to 7 mm Ø, younger **Br** 4 - 5 mm Ø; **L** linear-elliptic to -lanceolate, 40 - 75 × 1.5 - 3 mm, ± 4-ranked, flattish, glabrous, upper face flat to convex, lower face convex, margin acute, ciliate, tip acute; **Inf** rounded to flat-topped thyrses with several dense dichasia with pedicellate (lower down, to 10 mm) to sessile **Fl**; peduncle to 16 cm tall, with gradual transition from **L** to **Bra**; **Sep** linear-lanceolate, 3 - 3.5 × 0.75 mm, margin ciliate, tips acute; **Cl** tubular, 3 mm, cream; **Pet** oblanceolate to panduriform, erect, fused in lower ½; **Anth** yellow.

C. muricata Thunberg (Prodr. Fl. Cap., 55, 1794). **T**: RSA (Thunberg 7769 [UPS]). – **D**: RSA (Western Cape); Succulent Karoo, flowers spring to mid-summer.

Incl. *Crassula divaricata* Ecklon & Zeyher (1837).

[10] Erect fastigiate branched herbs to ± 25 cm tall; **R** tuberous; **Br** with recurved appressed **Ha**,

older **Br** with flaking bark; **L** ascending-spreading, 3 - 6 × 1 mm, deciduous with age, linear-lanceolate to elliptic, somewhat flattened, minutely papillate but old glabrescent, upper face flat to convex, lower face markedly convex, margin with few cilia, tip acute; **Inf** thyrses with cymose clusters of subsessile **Fl**; **Sep** oblong-triangular, subulate, to 3 mm, minutely papillate; **Cl** urceolate, lobes fused shortly at the base, white to cream, to 3.5 mm, panduriform, tips obtuse, without dorsal appendages; **Anth** yellow.

C. muscosa Linné (Pl. Rar. Afr., 10, 1760). **T** [lecto]: RSA, Cape Prov. (*Burman* s.n. [G]). – **D**: Namibia, RSA.

≡ *Tetraphyle muscosa* (Linné) Ecklon & Zeyher (1837) ≡ *Combesia muscosa* (Linné) P. V. Heath (1993); **incl.** *Sedum tillaei* E. H. L. Krause (1902) (*nom. illeg.*, Art. 52.1).

C. muscosa var. **muscosa** – **D**: Namibia, RSA (Eastern Cape, Northern Cape, Western Cape); flowers spring to mid-summer but occasionally after rain at other times.

Incl. *Crassula muscosa* fa. *variegata* hort. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Crassula imbricata* Burman fil. (1768); **incl.** *Crassula lycopodioides* Lamarck (1786) ≡ *Tetraphyle lycopodioides* (Lamarck) Ecklon & Zeyher (1837) ≡ *Sedum lycopodioides* (Lamarck) Kuntze (1898); **incl.** *Tetraphyle littoralis* Ecklon & Zeyher (1837) ≡ *Crassula littoralis* (Ecklon & Zeyher) Endlicher ex Walpers (1843) ≡ *Combesia muscosa* var. *littoralis* (Ecklon & Zeyher) P. V. Heath (1993); **incl.** *Crassula anguinea* Harvey (1862) ≡ *Combesia muscosa* var. *anguinea* (Harvey) P. V. Heath (1993); **incl.** *Crassula pseudolycopodioides* Dinter & Schinz (1909) ≡ *Crassula lycopodioides* var. *pseudolycopodioides* (Dinter & Schinz) E. Walther ex H. Jacobsen (1955) ≡ *Combesia muscosa* var. *pseudolycopodioides* (Dinter) P. V. Heath (1993); **incl.** *Lycopodium hieronymii* Herter (1909); **incl.** *Crassula lycopodioides* [?] *variegata* E. Lamb (1945) (*nom. inval.*, Art. 36.1); **incl.** *Crassula lycopodioides* fa. *acuminata* H. Jacobsen (1955) ≡ *Combesia muscosa* var. *acuminata* (H. Jacobsen) P. V. Heath (1993); **incl.** *Crassula lycopodioides* fa. *fragilis* G. D. Rowley (1955) ≡ *Combesia muscosa* var. *fragilis* (G. D. Rowley) P. V. Heath (1993); **incl.** *Crassula lycopodioides* fa. *fulva* H. Huber (1955) ≡ *Combesia muscosa* var. *fulva* (H. Huber) P. V. Heath (1993); **incl.** *Crassula lycopodioides* fa. *purpurea* H. Jacobsen (1955) ≡ *Combesia muscosa* var. *purpurea* (H. Jacobsen) P. V. Heath (1993).

[2] Erect to decumbent sparingly to densely branched perennials to 25 cm tall, very variable in size and **L** shape; **R** fibrous; **Br** often curving towards the light, main **Br** woody, to 1 cm Ø; **Int** invisible; **L** flat, grey- to brownish-green, often erect, all of the same length and densely imbricate form-

ing a square to terete **Bo** (when spreading with short axillary cymules), ovate-triangular to broadly so, 2 - 7 × 1.5 - 4 mm, margin entire with a row of hydathodes, tips acute to obtuse; **Inf** hardly distinct from the vegetative **Br**, thyrses with sessile axillary dichasia; **Cal** lobes oblong-triangular, to 1.5 mm; **Cl** cup-shaped, pale yellowish-green to brown, to 2 mm, lobes oblong-triangular, to 2 mm, acute; **Anth** yellow.

C. muscosa var. **obtusifolia** (Harvey) G. D. Rowley (Cact. Succ. J. Gr. Brit. 40(2): 53, 1978). **T**: RSA, Cape Prov. (Ecklon & Zeyher 1868 [S, FI, G, LE, P, SAM]). – **D**: S Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, rock outcrops, flowers spring to summer.

≡ *Crassula lycopodioides* var. *obtusifolia* Harvey (1862) ≡ *Combesia muscosa* var. *obtusifolia* (Harvey) P. V. Heath (1993); **incl.** *Tetraphyle propinqua* Ecklon & Zeyher (1837) ≡ *Crassula propinqua* (Ecklon & Zeyher) Endlicher ex Walpers (1843); **incl.** *Crassula muscosa* var. *rigida* Tölken (1975) (*nom. illeg.*, Art. 52.1).

[2] Differs from var. *muscosa*: Stems erect, basally woody, much branched; **Br** to 5 mm Ø at the base with peeling bark; **Int** visible; **L** broadly ovate, to 0.5 - 2 mm long and broad, yellowish-green; older **L** deciduous.

C. muscosa var. **parvula** (Ecklon & Zeyher) Tölken (JSAB 41: 111, 1975). **T**: RSA, Eastern Cape (Ecklon & Zeyher 1871 [S]). – **D**: RSA (Eastern Cape); Karoo and thickets, rock outcrops, flowers mid-summer to autumn.

≡ *Tetraphyle parvula* Ecklon & Zeyher (1837) ≡ *Crassula parvula* (Ecklon & Zeyher) Endlicher ex Walpers (1843) ≡ *Combesia muscosa* var. *parvula* (Ecklon & Zeyher) P. V. Heath (1993).

[2] Differs from var. *muscosa*: Erect and tufted; **Br** 3 - 4 mm Ø, **Int** visible, old **Br** basally with flaking bark; **L** lanceolate, to 2 × 1 mm, grey-green; old **L** deciduous.

C. muscosa var. **polpodacea** (Harvey) G. D. Rowley (Cact. Succ. J. Gr. Brit. 40(2): 53, 1978). **T**: RSA, Eastern Cape (Ecklon & Zeyher 1869 [G, LE, P, S, SAM]). – **D**: RSA (Eastern Cape); rocky valleys in thickets, flowers mid-summer to winter.

≡ *Tetraphyle polpodacea* Ecklon & Zeyher (1837) ≡ *Crassula polpodacea* (Ecklon & Zeyher) Endlicher ex Walpers (1843) ≡ *Crassula lycopodioides* var. *polpodacea* (Ecklon & Zeyher) Harvey (1862) ≡ *Combesia muscosa* var. *polpodacea* (Ecklon & Zeyher) P. V. Heath (1993); **incl.** *Crassula muscosa* var. *sinuata* Tölken (1975) (*nom. illeg.*, Art. 52.1).

[2] Differs from var. *muscosa* by its sinuous decumbent thin yellowish-green **Br** to 4 mm Ø and the lacking axillary cymules; **L** lanceolate, tough, 2 - 3 × 1 - 2 mm.

C. namaquensis Schönland & Baker *fil.* (J. Bot. 36: 367, 1898). **T** [syn]: RSA, Northern Cape (*Alston* s.n. [GRA, SAM]). – **D**: RSA.

C. namaquensis ssp. **comptonii** (Hutchinson & Pillans) Tölken (JSAB 41: 112, 1975). **T**: RSA, Northern Cape (*Hutchinson* 765 [K]). – **D**: RSA (Northern Cape); dry Fynbos, shallow depressions on quartzitic sandstones.

≡ *Crassula comptonii* Hutchinson & Pillans (1946).

[17] Differs from ssp. *namaquensis*: **Br** very short, to 3 mm Ø; **L** shorter, oblanceolate to almost club-shaped, almost triangular to round in cross-section, epidermis with much longer and coarser **Ha**; **Inf** with 1 - 3 dichasia; peduncle 1.5 - 5 cm; **Cl** to 5 mm, yellow, lobes narrowly oblanceolate-panduriform, beak-like appendage ± 2 mm.

C. namaquensis ssp. **lutea** (Schönland) Tölken (JSAB 41: 112, 1975). **T**: RSA, Northern Cape (*Marloth* 3238 [GRA, K]). – **D**: RSA (Northern Cape, Western Cape); Dry Fynbos and Succulent Karoo mosaic, flowers spring to early summer.

≡ *Crassula namaquensis* var. *lutea* Schönland (1904) ≡ *Crassula lutea* (Schönland) H.-C. Friedrich (1974).

[17] Differs from ssp. *namaquensis*: **L** narrowly elliptic, acute, to 30 mm, triangular to round in cross-section, epidermis with much longer and coarser **Ha**; **Inf** with 1 terminal dichasium; **Cl** to 10 mm, yellow, lobes narrowly oblanceolate-panduriform, beak-like appendage ± 2 mm.

C. namaquensis ssp. **namaquensis** – **D**: RSA (Northern Cape); Succulent Karoo, quartz gravel flats.

Incl. *Crassula namaquensis* var. *brevifolia* Schönland (1910).

[17] Dwarf, sparingly branched, forming spreading tufts 3 × 5 cm with **L** in basal **Ros**; **R** fibrous; **Br** short, to 12 mm Ø; **L** elliptic to lanceolate, 12 - 35 × 3 - 10 mm, old persistent, lamina flat, with short stiff recurved **Ha**, grey-green, upper face flat to convex, lower face convex, tip obtuse or acute; **Inf** thyrses with globose dichasia; peduncle to 15 cm; **Sep** lorate-triangular, to 3 mm; **Cl** tubular, fused basally for 5 mm, white to cream, lobes to 4 mm, broadly oblanceolate-panduriform, with a beak-like appendage ≤ 1 mm; **Anth** black.

C. natalensis Schönland (Bull. Herb. Boissier 5: 861, 1897). **T**: RSA, KwaZulu-Natal (*Wood* 4637 [GRA, K]). – **D**: Lesotho, RSA (Eastern Cape, KwaZulu-Natal); grassland on rock outcrops, flowers mid-summer to autumn.

Incl. *Crassula rubescens* Schönland & Baker *fil.* (1898); **incl.** *Crassula sessilifolia* Baker *fil.* (1903); **incl.** *Crassula rubescens* var. *intermedia* Schönland (1929); **incl.** *Crassula rubescens* var. *laxa* Schönland (1929).

[14] Rosulate biennials, solitary or proliferating from the base to form small clusters, to 40 cm tall (**incl. Inf**); **R** fibrous; **L** 10 - 60 × 5 - 15 mm, flattened, obovate to elliptic, glabrous, green to reddish when exposed, upper face flat to slightly channelled, lower face convex, margin ciliate, tips blunt; **Inf** terminal round-topped thyrses with 1 to few dichasia; **Fl** pedicellate; **Sep** to 2.5 mm, triangular, margins sparingly toothed, tips with apical sturdy **Ha**; **Cl** white, tubular, to 4 mm; **Pet** oblong-elliptic, to 3 mm, fused shortly at the base, spreading to recurved, tips rounded and slightly cucullate; **Anth** reddish-brown.

C. natans Thunberg (Prodr. Fl. Cap., 54, 1794). **T**: RSA, Cape Prov. (*Thunberg* 7772 [UPS, G, S]). – **D**: RSA.

≡ *Helophytum natans* (Thunberg) Ecklon & Zeyher (1836).

C. natans var. **minus** (Ecklon & Zeyher) G. D. Rowley (Cact. Succ. J. Gr. Brit. 40(2): 53, 1978). **T**: RSA, Western Cape (*Ecklon & Zeyher* 1843b [S, SAM]). – **D**: RSA (Western Cape); in seasonal pools, flowers winter to spring; naturalized in SW to SE Australia at least as early as 1883. **I**: Tölken (1985: 106, fig. 13: 1a).

≡ *Helophytum natans* var. *minus* Ecklon & Zeyher (1837); **incl.** *Bulliarda filiformis* Ecklon & Zeyher (1837) ≡ *Helophytum natans* var. *filiforme* (Ecklon & Zeyher) Harvey (1862) ≡ *Crassula natans* fa. *filiformis* (Ecklon & Zeyher) Schönland (1917) ≡ *Crassula natans* var. *filiformis* (Ecklon & Zeyher) Tölken (1975) ≡ *Crassula natans* ssp. *filiformis* (Ecklon & Zeyher) H.-C. Friedrich (1979); **incl.** *Tillaea capensis* var. *minor* Walpers (1843); **incl.** *Tillaea ecklonis* Walpers (1843).

[1] Differs from var. *natans*: **Br** to 0.5 mm Ø; **L** linear to linear-elliptic, to 1 mm wide; **Ped** to 3 mm; **Cl** lobes to 1 mm, oblanceolate.

C. natans var. **natans** – **D**: RSA (widespread from the Cape to Free State, KwaZulu-Natal, Gauteng and Mpumalanga); shallow seasonal pools in Succulent Karoo, Fynbos and grassland, flowers late autumn to mid-summer. **I**: Tölken (1985: 106). **Fig. VIII.e**

Incl. *Tillaea capensis* Linné *fil.* (1782) ≡ *Bulliarda capensis* (Linné *fil.*) E. Meyer ex Drège (1843); **incl.** *Helophytum filiforme* Ecklon & Zeyher (1837) ≡ *Tillaea filiformis* (Ecklon & Zeyher) Endlicher ex Walpers (1843); **incl.** *Helophytum filiforme* var. *parvulum* Ecklon & Zeyher (1837) ≡ *Tillaea filiformis* var. *parvula* (Ecklon & Zeyher) Endlicher ex Walpers (1843); **incl.** *Helophytum fluitans* Ecklon & Zeyher (1837) ≡ *Tillaea fluitans* (Ecklon & Zeyher) Endlicher ex Walpers (1843) ≡ *Helophytum natans* var. *fluitans* (Ecklon & Zeyher) Harvey (1862) ≡ *Crassula natans* fa. *fluitans* (Ecklon & Zeyher) Schönland (1917); **incl.** *Helophytum flui-*

tans var. *intermedium* Ecklon & Zeyher (1837) = *Tillaea fluitans* var. *intermedia* (Ecklon & Zeyher) Endlicher ex Walpers (1843); **incl.** *Helophytum fluitans* var. *obovatum* Ecklon & Zeyher (1837) = *Tillaea fluitans* var. *obovata* (Ecklon & Zeyher) Endlicher ex Walpers (1843) = *Helophytum natans* var. *obovatum* (Ecklon & Zeyher) Harvey (1862) = *Crassula natans* fa. *obovata* (Ecklon & Zeyher) Schönland (1917); **incl.** *Helophytum reflexum* Ecklon & Zeyher (1837) = *Tillaea reflexa* (Ecklon & Zeyher) Endlicher ex Walpers (1843); **incl.** *Helophytum natans* var. *amphibia* Harvey (1862) = *Crassula natans* fa. *amphibia* (Harvey) Schönland (1917); **incl.** *Crassula natans* fa. *parvifolia* Schönland (1917); **incl.** *Crassula levynsiae* Adamson (1943).

[1] Spreading aquatic annuals (often in large monospecific stands); **Br** to 25 cm (usually much shorter), to 5 mm Ø; **L** 3 - 12 × 1 - 4 mm, flat, oblanceolate, lorate to obovate, surface glabrous, green, turning conspicuously deep red at the end of the wet season, tips obtuse to acute; **Ped** to 15 mm; **Cal** to 0.5 mm, **Sep** broadly triangular, tips obtuse; **Cl** cup-shaped, white, lobes to 2 mm, obovate; **Anth** yellow to purple.

C. nemorosa (Ecklon & Zeyher) Endlicher ex Walpers (Repert. Bot. Syst. 2: 253, 1843). **T:** RSA, Eastern Cape (Ecklon & Zeyher 1859 [K, S, SAM, TCD]). – **D:** RSA (Northern Cape, Western Cape, Eastern Cape); mountains, in the shade of rocks, flowers winter to spring and sporadically after rains.

= *Petrogeton nemorosum* Ecklon & Zeyher (1837) = *Septas nemorosa* (Ecklon & Zeyher) P. V. Heath (1993); **incl.** *Petrogeton nivale* Ecklon & Zeyher (1837) = *Crassula nivalis* (Ecklon & Zeyher) Endlicher ex Walpers (1843); **incl.** *Crassula confusa* Schönland & Baker fil. (1898); **incl.** *Crassula coerulescens* Schönland (1929).

[7] Geophytes with erect branched or unbranched stems to 15 cm; tuber globose with fibrous adventitious **R**; **L** in > 3 pairs, 3 - 15 × 4 - 13 mm, flattened, broadly ovate to orbicular, margin entire, surface glabrous, grey-green with brown lines, base cordate to abruptly cuneate, tip rounded to truncate; petiole 3 - 15 mm; **Inf** lax terminal thyrses without peduncle; **Sep** triangular-ovate, to 2.5 mm, acute to obtuse; **Cl** stellate, shallowly cup-shaped, to 8 mm Ø, yellowish-green, lobes lanceolate, to 3.5 mm, tips becoming recurved; **Anth** yellow.

C. nudicaulis Linné (Spec. Pl. [ed. 1], 283, 1753). **T:** [lecto – icono]: Dillenius, Hort. Eltham. t. 98, fig. 115, 1732. – **D:** RSA, Lesotho.

= *Globulea nudicaulis* (Linné) Haworth (1812).

C. nudicaulis var. *herrei* (H.-C. Friedrich) Tölken (JSAB 41: 113, 1975). **T:** RSA, Northern Cape (*Herre* s.n. in *SUG* 8126 [M]). – **D:** RSA (Northern

Cape); Succulent Karoo, flowers spring and early summer.

= *Crassula herrei* H.-C. Friedrich (1967) = *Globulea nudicaulis* var. *herrei* (H.-C. Friedrich) P. V. Heath (1995).

[20] Differs from var. *nudicaulis*: **Int** longer, 5 - 10 mm; **L** not rosulate, oblong-lanceolate to almost linear, 30 - 80 × 5 - 8 mm, glabrous, reddish-brown to green, upper face flat to channelled, lower face convex, tips acute to obtuse.

C. nudicaulis var. *nudicaulis* – **D:** RSA (Northern Cape, Western Cape, Eastern Cape, Free State, KwaZulu-Natal), Lesotho; grassland, Nama and Succulent Karoo, usually among rocks.

incl. *Crassula obvallata* Linné (1767) = *Globulea obvallata* (Linné) Haworth (1812); **incl.** *Crassula cephalophora* Thunberg (1778) = *Purgosea cephalophora* (Thunberg) G. Don (1834); **incl.** *Globulea canescens* Haworth (1812) = *Sedum canescens* (Haworth) Kuntze (s.a.) = *Crassula canescens* (Haworth) Schultes (1820); **incl.** *Globulea capitata* Salm-Dyck ex Haworth (1821); **incl.** *Globulea sulcata* Haworth (1821) = *Crassula sulcata* (Haworth) D. Dietrich (1840); **incl.** *Crassula hirta* Thunberg (1823) = *Purgosea hirta* (Thunberg) G. Don (1834); **incl.** *Globulea lingua* Haworth (1824); **incl.** *Globulea canescens* var. *angustifolia* Ecklon & Zeyher (1837) = *Crassula canescens* var. *angustifolia* (Ecklon & Zeyher) Harvey (1862); **incl.** *Crassula nudicaulis* var. *glabra* Schönland (1910); **incl.** *Crassula cephalophora* var. *basutica* Schönland (1929); **incl.** *Crassula cephalophora* var. *thunbergii* Schönland (1929); **incl.** *Crassula hirta* var. *dyeri* Schönland (1929).

[20] Low-growing perennials, variable in size, to 12 cm tall (excl. **Inf**), with several dense **Ros**, offsetting and sometimes forming mats; **L** variable in shape and vestiture, ascending-spreading, linear to lorate to linear-obovate, 18 - 100 × 6 - 18 mm, flattened, glabrous or hairy, green to dark maroon, upper face flat, lower face convex, margins minutely ciliate to entire, tips obtuse to acute; **Inf** erect spike-like thyrses to 20 cm with several sessile to shortly stalked dichasia; peduncle glabrous to pubescent, with ≤ 7 pairs of erect ovate-triangular **Bra** to 6 mm; **Fl** densely glomerate; **Sep** oblong-triangular, to 3 mm, obtuse, ciliate; **Cl** tubular, cream to white; **Pet** shortly fused at the base, to 4.5 mm, panduriform, tips with ellipsoid appendages; **Anth** yellow.

C. nudicaulis var. *platyphylla* (Harvey) Tölken (JSAB 41: 113, 1975). **T:** RSA (*Drège* 6896 [S, G, LE]). – **D:** RSA (Western Cape); Succulent and Nama Karoo, flowers spring and early summer.

= *Crassula platyphylla* Harvey (1862) = *Globulea nudicaulis* var. *platyphylla* (Harvey) P. V. Heath (1995).

[20] Differs from var. *nudicaulis*: **L** oblong-ellip-

tic to almost circular, flattened, 1 - 3 cm, both faces flat, glabrous, margins with a row of cilia.

C. numaisensis H.-C. Friedrich (Mitt. Bot. Staats-samml. München 6: 642-643, 655, fig. 12, 1967). **T:** Namibia (*Merxmiller & Giess* 3389a [M, K, WIND]). – **D:** Namibia; Succulent Karoo, shady rock boulders, spring-flowering.

[2] Decumbent glabrous perennials to 8 cm Ø; **R** fibrous; **L** 6 - 15 × 4 - 10 mm, green, (sub-) sessile, obovate, tip obtuse; **Inf** rounded thyrses with many dichasia; **Fl** distinctly pedicellate, 5-merous; **Cal** lobes to 2.5 mm, oblong-lanceolate; **Cl** cup-shaped, white, lobes spreading, to 2 mm; **Anth** yellow.

C. oblanceolata Schönland & Baker *fil.* (J. Bot. 36: 365, 1898). **T:** RSA, Cape Prov. (*Schlechter* 8306 [GRA, BM, BOL, G, K, PRE]). – **D:** S Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, shady places in dense stands, spring-flowering.

Incl. *Crassula lambertiana* Schönland & Baker *fil.* (1898).

[2] Erect to decumbent glabrous green to reddish annuals to 6 cm tall and 12 cm Ø; **L** flat, 3 - 8 × 1 - 4 mm, sessile, oblanceolate to narrowly elliptic, tip obtuse; **Inf** thyrses with 1 to many dichasia; **Fl** 4- or 5-merous, pedicellate; **Cal** lobes oblong-lanceolate, to 3 mm; **Cl** cup-shaped, white, lobes spreading, elliptic, to 3 mm, tips obtuse; **Anth** yellow.

C. obovata Haworth (Suppl. Pl. Succ., 18, 1819). **T:** K [lecto: unpubl. pl. 775]. – **D:** RSA.

C. obovata var. **dregeana** (Harvey) Tölken (JSAB 41: 113, 1975). **T** [lecto]: RSA (*Drège* s.n. [S, BM, G, K, LE, LU, P, SAM, TCD]). – **D:** RSA (KwaZulu-Natal); quartzitic sandstone rock-outcrops in coastal grassland, flowers in autumn to mid-winter.

≡ *Crassula dregeana* Harvey (1862) ≡ *Sedum dregeanum* (Harvey) Kuntze (1898); **incl.** *Crassula longistyla* Schönland (1913).

[14] Differs from var. *obovata*: **L** obovate to spatulate, much thicker than 2 mm, densely covered with coarse grey recurved **Ha**; **Inf** 2- to 10-flowered.

C. obovata var. **obovata** – **D:** RSA (KwaZulu-Natal to Eastern Cape); rock outcrops in grassland, autumn-flowering.

Incl. *Crassula ramuliflora* Link & Otto (1821) ≡ *Sedum ramuliflorum* (Link & Otto) Kuntze (1898); **incl.** *Crassula stachygera* Ecklon & Zeyher (1837) ≡ *Crassula ramuliflora* var. *stachygera* (Ecklon & Zeyher) Schönland (1929); **incl.** *Crassula stachygera* var. *rotundifolia* Harvey (1862); **incl.** *Sedum ramuliflorum* fa. *rubriflorum* Kuntze (1898); **incl.** *Sedum ramuliflorum* var. *oblongifolium* Kuntze (1898); **incl.** *Crassula inchangensis* Engler (1907); **incl.** *Crassula peglerae* Schönland (1907); **incl.**

Crassula reversisetosa Bitter (1924); **incl.** *Crassula ramuliflora* var. *bewsii* Schönland (1929); **incl.** *Crassula ramuliflora* var. *bolusii* Schönland (1929); **incl.** *Crassula ramuliflora* var. *flanaganii* Schönland (1929); **incl.** *Crassula ramuliflora* var. *ratrayi* Schönland (1929); **incl.** *Crassula ramuliflora* var. *simii* Schönland (1929); **incl.** *Crassula sediflora* var. *laxifolia* Schönland (1929); **incl.** *Crassula ramuliflora* var. *typica* Schönland (1929) (*nom. inval.*, Art. 24.3).

[14] Small spreading decumbent branched perennials to 30 cm tall; **L** in **Ros** when young, 4-ranked, 5 - 30 × 3 - 17 mm, lanceolate, elliptic to obovate, flattened and not thicker than 2 mm, glabrous or covered with appressed **Ha**, green to reddish-green, upper face flat to slightly convex, lower face convex to cymbiform, margin distinctly ciliate, base cuneate, tip obtuse to acute; **Inf** erect terminal round to flat-topped thyrses with 1 to many dichasia; **Bra** **L**-like becoming shorter upwards; **Fl** 8 - 16, shortly pedicellate, laxly arranged; **Sep** to 5 mm, narrowly triangular, glabrous, tips with a short recurved **Ha**, margin ciliate; **Cl** tubular, cream to white, to 8 mm; **Pet** oblong-lanceolate, to 7 mm, fused shortly at the base, tips rounded and slightly cucullate, recurved; **Anth** purple; **Ca** with 12 - 26 ovules.

C. obtusa Haworth (Suppl. Pl. Succ., 16, 1819). **T:** [lecto – icono]: Curtis's Bot. Mag. 47: t. 2178, 1820. – **D:** RSA (Western Cape, Eastern Cape); mountainous Fynbos, acid soil on quartzitic sandstone, flowers mid-summer.

Incl. *Crassula jasminea* Haworth *ex* Sims (1820) ≡ *Kalosanthes jasminea* (Haworth *ex* Sims) Haworth (1821) ≡ *Rochea jasminea* (Haworth *ex* Sims) De Candolle (1828) ≡ *Dietrichia jasminea* (Haworth *ex* Sims) Ecklon & Zeyher (1837); **incl.** *Rochea microphylla* E. Meyer *ex* Drège (1843) (*nom. inval.*, Art. 32.1c).

[13] Decumbent moderately branched perennials to 17 cm tall, rooting at the nodes; **Br** 2 mm Ø, reddish, old 3 mm Ø with brown bark; **Int** distinctly visible; **L** ascending-spreading, reddish to greenish, 10 - 17 × 2 - 3 mm, linear-elliptic, upper face flat, lower face convex, margin ciliate, tip obtuse to acute; old **L** persistent; **Inf** dichasia with 1 - 5 **Fl**; peduncle indistinct; **Ped** 2 - 7 mm; **Sep** 12 mm, reddish, linear-lanceolate, to 8 mm, margin ciliate, tip acute; **Cl** tubular, 30 × 20 mm Ø, white; **Pet** fused for 25 mm at the base, lobes spreading, obovate-lanceolate, 7 × 4 mm; **St** to 25 mm; **Anth** black; **Sti** reaching the throat, sometimes slightly exerted.

C. orbicularis Linné (Spec. Pl. [ed. 1], 283, 1753). **T:** [lecto – icono]: Dillenius, Hort. Eltham. t. 100, fig. 119, 1732. – **D:** RSA (Western Cape, Eastern Cape, KwaZulu-Natal); thickets in shade, flowers winter to mid-summer. **Fig. VIII.f**

≡ *Purgosea orbicularis* (Linné) P. V. Heath

(1993); **incl.** *Crassula sedoides* Miller (1768); **incl.** *Crassula rosularis* Haworth (1821).

[14] Rosulate, offsetting and forming dense groups to 30 - 50 cm Ø, 2 - 4 cm tall (excl. **Inf**); **R** fibrous; main **Br** short, often offsetting with long arching runners; **L** 10 - 12 in dense **Ros** to 6 cm Ø, lamina flat, green to purplish on the lower face, 30 - 45 × 10 - 16 mm, oblanceolate, margins ciliate, tip acute; **Inf** terminal ascending elongated thyrses to 16 cm with several dichasia; peduncle 3 - 7 cm; **Ped** short, to 1 mm; **Cl** 2 - 4 mm Ø, shortly tubular; lobes white, ovate-lanceolate, white to cream, to 3 mm.

C. ovata (Miller) Druce (Bot. Soc. Exch. Club Brit. Isles 1917: 617, 1917). **T** [neo]: RSA, Eastern Cape (*Töken* 1772 [BOL]). – **D**: RSA (Eastern Cape, KwaZulu-Natal); Valley Bushveld, rock outcrops, flowers mid-winter to early spring. **I**: Tölken (1985: 80, fig. 12: 3). **Fig. VIII.g**

≡ *Cotyledon ovata* Miller (1768) ≡ *Toelkenia ovata* (Miller) P. V. Heath (1993); **incl.** *Crassula argentea* Thunberg (1778); **incl.** *Crassula portulacea* Lamarck (1786); **incl.** *Crassula obliqua* Aiton (1789); **incl.** *Crassula articulata* Zuccagni (1806); **incl.** *Crassula nitida* Schönland (1903); **incl.** *Crassula lucens* Gram (1941).

[6] Erect rounded thick-stemmed much-branched shrubs to 2.5 m tall, usually sparingly branched at the base but occasionally with a single main stem to 6 cm Ø; **Br** succulent, grey-green with older bark peeling in horizontal brownish strips; **L** shortly petiolate to 5 mm, ascending-spreading, green, glabrous, often with reddish acute margins, obovate, 3 - 9 × 1.8 - 4 cm, base cuneate, tip acute, often mucronate; **Inf** terminal round-topped thyrses 5 × 5 cm with numerous dichasia; peduncle 15 - 18 × 2 mm; **Ped** 5 mm; **Sep** ± 2 mm, fused basally; **Cl** stellate, 15 mm Ø, pink or white; **Pet** 7 × 2.5 mm, lanceolate; **Fil** 5 mm.

Better known and still frequently cultivated under the younger synonym *C. portulacea*.

C. pageae Tölken (JSAB 41: 113, 1975). **T**: RSA, Cape Prov. (*Page* s.n. [GRA, BOL, PRE]). – **Lit**: Jäger-Zürn (1989). **D**: RSA (Northern Cape, Western Cape); Succulent Karoo, shade of herbs and shrubs, flowers in mid-winter and spring.

Incl. *Pagella archeri* Schönland (1921).

[2] Compact minute annual succulent herbs reduced to flat crust-like **Ros** on the ground, to ± 2 cm Ø; **R** fibrous; stems condensed and partly fused to the **L** bases; **L** 2 - 5 × 1.5 - 3 mm, sessile, spatulate, broadening towards base and tip, surface minutely papillose; **Inf** condensed terminal thyrses; **Fl** sessile, 4-merous; **Cal** lobes obovate-oblong, to 1 mm; **Cl** cup-shaped, brown to red, lobes almost free, 1.2 - 2 mm, obtuse, erect; **Anth** yellow; **Ca** basally united and sunken into the **Rec**, each with 2 ovules; **Fr** indehiscent.

This highly specialized member of the genus has a widely aberrant morphology (different parts are variously fused together) which was admirably analysed by Jäger-Zürn (1989). A placement in a separate genus (*Pagella*) is not warranted.

C. pallens Schönland & Baker *fil.* (J. Bot. 36: 361, 1898). **T**: RSA, Northern Cape (*Schlechter* 8310 [GRA, BM, BOL]). – **D**: Namibia, RSA (Northern Cape); Succulent Karoo, spring-flowering.

[10] Much-branched shrublets 50 cm tall; **R** fibrous; **Br** with recurved **Ha**, becoming glabrous and with smooth pale bark; **L** 10 - 35 × 2 - 7 mm, deciduous when old, glaucous-green, linear-lanceolate to lanceolate, flattened, minutely papillate, upper face flat to concave, lower face convex, margin basally with few cilia, tip acute; **Inf** irregular thyrses with several dichasia; **Fl** subsessile; **Sep** triangular to triangular-lanceolate, to 3 mm, minutely papillate without marginal cilia; **Cl** tubular, lobes fused shortly at the base, white to cream, to 3.5 mm, lorate to subpanduriform, tip obtuse with dorsal appendage; **Anth** black.

C. papillosa Schönland & Baker *fil.* (J. Bot. 36: 371, 1898). **T**: RSA, Cape Prov. (*Marloth* 1999 [GRA, BM, PRE]). – **D**: RSA (Western Cape, Eastern Cape); rock outcrops in shade, seasonally moist areas at high altitude, flowers mid-summer to autumn.

Incl. *Crassula limosa* Schönland (1903).

[4] Spreading delicate mat-forming perennials to 20 cm Ø; **Br** rooting at the nodes; **R** fibrous; **L** 1.5 - 3 × 0.5 - 1.5 mm, sessile or with a petiole to 1 mm, lamina flat, elliptic to oblanceolate, biconvex, minutely papillose, green to reddish-green, tip obtuse; **Fl** axillary, solitary; **Cal** lobes to 2 mm, lanceolate to ovate, acute to obtuse; **Cl** cup- to saucer-shaped, lobes to 3 mm, elliptic-oblong, white and somewhat translucent, acute, recurved; **Anth** yellow.

C. peculiaris (Tölken) Tölken & Wickens (in Leistner & al. (ed.), Fl. South Afr. 14: 123, 1985). **T**: RSA, Eastern Cape (*Esterhuysen* 28832 [BOL]). – **D**: RSA (Eastern Cape: vicinity of Swartberg Pass); moist places in the shade of rocks.

≡ *Crassula expansa* ssp. *peculiaris* Tölken (1975).

[4] Perennials; **Br** slender, prostrate, to 30 cm in lax mats, sometimes rooting; **L** petiolate to 3 mm, ovate to broadly elliptic, 3 - 8 (-10) × (2-) 4 - 6 mm, mostly obtuse, flat, green, with a dense cover of fine **Ha**; **Fl** solitary in the **L** axils; **Sep** linear-lanceolate, ± 3 mm, obtuse to rounded, scatteredly hairy, fleshy, green; **Cl** cup-shaped; **Pet** almost free, white, elliptic-oblong, 3.5 - 4 mm, obtuse to rounded, erect or slightly recurved; **Anth** yellowish; **Se** distinctly papillose.

C. peduncularis (Smith) Meigen (BJS 17: 239,

1893). **T**: Uruguay (*Commerson* s.n. [LINN-SM, BM, G, G-DC, K [photo]]). – **D**: S Brazil, Paraguay, Argentina, Chile, S Australia, New Zealand; terrestrial in wet mud, to 1500 m. **I**: Bywater & Wickens (1984: 717, fig. 4: A-E).

≡ *Tillaea peduncularis* Smith (1817); **incl.** *Bulliarda bonariensis* De Candolle (1801) (*nom. inval.*, Art. 32.1c) ≡ *Crassula bonariensis* (De Candolle) Cambessèdes (1828) (*nom. inval.*, Art. 32.1c) ≡ *Tillaea bonariensis* (De Candolle) Britton (1930) (*nom. inval.*, Art. 32.1c); **incl.** *Tillaea purpurata* Hooker fil. (1841) ≡ *Crassula purpurata* (Hooker fil.) Domin (1925); **incl.** *Tillaea paludosa* Schlechtendal (1857) (*nom. inval.*, Art. 32.1c); **incl.** *Crassula paludosa* Schlechtendal ex Reiche (1898); **incl.** *Crassula caudiculata* Bacigalupo & Rossow (1984).

[1] Erect or decumbent annuals to 6 cm; **L** lanceolate to narrowly triangular, (2.5-) 3 - 5 mm, acute, green to deep red; **Fl** 1 per node, 4-merous; **Ped** extending in **Fr**, (0.5-) 5.5 - 9 (-11) mm; **Sep** triangular, 1 - 1.5 × 0.5 - 0.7 mm, acute; **Cl** cup-shaped, white tinged ± red; **Pet** triangular-ovate, 1.3 - 1.7 × 0.5 mm, acute, longer than the **Sep**; **Nsc** narrowly oblong, 0.6 mm; **Se** (6-) 8 - 9 (-16) per **Ca**, oblong, reddish-brown, ± 0.35 - 0.45 × 0.15 - 0.2 mm, longitudinally striate, papillate. – [U. Eggli]

C. pellucida Linné (Spec. Pl. [ed. 1], 283, 1753). **T**: [lecto – icono]: Dillenius, Hort. Eltham. t. 100: fig. 119, 1732. – **D**: Tropical and S Africa.

≡ *Gomara pellucida* (Linné) P. V. Heath (1993).

This is an exceedingly variable complex of taxa, and some authors believe that *C. alsinoides* and probably also *C. brachypetala* should be re-instated at species rank.

C. pellucida ssp. *alsinoides* (Hooker fil.) Tölken (JSAB 41: 114, 1975). **T**: Fernando Po (*Mann* 1450 [K]). – **D**: Tropical Africa (Kenya, Uganda, Tanzania) S-wards to RSA (KwaZulu-Natal, Mpumalanga), Swaziland, Madagascar; Afro-temperate forest, often near streams, flowers spring to autumn. **I**: Gilbert (1989: 7, as *C. alsinoides*).

≡ *Tillaea alsinoides* Hooker fil. (1864) ≡ *Crassula alsinoides* (Hooker fil.) Engler (1892); **incl.** *Crassula nummulariifolia* Baker (1883).

[6] Differs from ssp. *pellucida*: Stems semitranslucent, ± 2 mm Ø, with 2 bands of interpetiolar **Ha** running down the stem between the nodes (or when stems glabrous then with a tuft of **Ha** where the **L** bases fuse); **L** ovate, acute, semitranslucent and sometimes with reddish striations; **Inf** reduced to solitary **Fl** in the **L** axils; **Sep** shorter than the **Pet**.

C. pellucida ssp. *brachypetala* (Drège ex Harvey) Tölken (JSAB 41: 114, 1975). **T**: RSA, Eastern Cape (*Drège* s.n. [S, G, K, P]). – **D**: Tropical Africa S-wards to N, E and SE RSA; Afro-temperate forest margins and grasslands, flowers mid-summer to autumn.

≡ *Crassula brachypetala* Drège ex Harvey (1862); **incl.** *Crassula prostrata* E. Meyer ex Drège (1844) (*nom. inval.*, Art. 32.1c); **incl.** *Bulliarda dregei* Harvey (1862) ≡ *Crassula dregei* (Harvey) Schönland (1917); **incl.** *Crassula elongata* Schönland (1897); **incl.** *Crassula involucrata* Schönland (1897); **incl.** *Crassula tysonii* Schönland (1902); **incl.** *Crassula diabolica* N. E. Brown (1926); **incl.** *Crassula lineolata* fa. *gracilis* Schönland (1929); **incl.** *Crassula lineolata* fa. *magna* Schönland (1929); **incl.** *Crassula lineolata* fa. *natalensis* Schönland (1929); **incl.** *Crassula lineolata* var. *petiolata* Schönland (1929); **incl.** *Crassula lineolata* var. *pilosa* Schönland (1929) (*nom. inval.*, Art. 32.1c).

[6] Differs from ssp. *pellucida*: Stems decumbent, to ± 1 mm Ø, with 2 bands of interpetiolar **Ha** running down the stem between the nodes; **L** ovate-lanceolate, shortly petiolate to sessile, petiole or **L**-base with marginal ciliae; **Inf** terminal dichasia; **Ped** hairy; **Sep** as long or longer than the **Pet**.

C. pellucida ssp. *marginalis* (Aiton) Tölken (JSAB 41: 114, 1975). **T**: RSA, Cape Prov. (*Masson* s.n. [BM]). – **D**: RSA (Western Cape, Eastern Cape); Afro-temperate forest margins, mountain slopes, thickets and shady kloofs, often in rock-crevices or epiphytic, flowers spring to mid-summer.

≡ *Crassula marginalis* Aiton (1789); **incl.** *Crassula lineolata* Aiton (1789); **incl.** *Crassula profusa* Hooker fil. (1873).

[6] Differs from ssp. *pellucida*: **Br** procumbent (or drooping from cliff faces), sturdier, often with adventitious aerial **R**, glabrous, terete, green to reddish, to 2 mm Ø; **L** variable in size and colour, broadly ovate to ovate-triangular, basally fused within a pair, margins reddish, horny; **Inf** terminal dichasia, often rounded-umbellate, ± 20 mm Ø; **Ped** glabrous; **Sep** linear-lanceolate, to 1.5 mm; **Pet** lanceolate to elliptic, to 3 mm.

Very variable in leaf size and colour with several local forms.

C. pellucida ssp. *pellucida* – **D**: RSA (Western Cape); moist shady places in forests and Fynbos, summer-flowering.

Incl. *Crassula marginata* Thunberg (1794).

[6] Procumbent, mat-forming; **R** fibrous; **Br** to ± 60 cm, often rooting at the nodes, terete, green, to 3 mm Ø; **Int** 1 - 3 cm; **L** ovate to broadly ovate, green, 10 - 22 × 7 - 18 mm, tip obtuse or acute, margins entire to subdentate, papillose, base cuneate, decurrent on the stem and fused shortly at the base to the opposite **L** of the pair; **Inf** irregular terminal dichasia to 3 cm tall (rarely reduced to single **Fl** in the **L** axils); **Ped** 5 - 7 mm; **Sep** linear-triangular, to 2 × 1 mm; **Cl** stellate, white to pink, to 10 mm Ø; **Pet** ovate, acute, 3 × 2 mm; **Fil** 2 mm; **Anth** yellow.

C. pellucida ssp. *spongiosa* Tölken (JSAB 41:

114-115, 1975). **T:** RSA, Western Cape (*Barker* 10739 [NBG]). – **D:** RSA (Western Cape); sandy soil in sheltered kloofs, spring-flowering.

[6] Differs from ssp. *pellucida*: Annuals, stems decumbent, glabrous; **L** elliptic, base cuneate, tip acute, sheath glabrous or with few scattered cilia; **Inf** terminal dichasia; **Sep** as long as the **Pet**, becoming spongy after flowering.

C. peploides Harvey (FC 2: 355, 1862). **T:** RSA, Eastern Cape (*Drège* 6880 [S, LE, P]). – **D:** RSA (Eastern Cape, KwaZulu-Natal), Lesotho; in grassland in shallow rock pockets, flowers summer and autumn. **I:** Tölken (1985: 144, fig. 16: 2). **Fig. VIII.h**

Incl. *Crassula galpinii* Schönland (1897).

[8] Erect perennials with several stems to 9 cm tall from a rhizomatous base; **Br** 2 mm Ø, pale green; **L** green, often tinged red, at first crowded in basal **Ros**, lanceolate, oblanceolate to triangular-ovate, 2 - 15 × 1 - 3 mm, with visible hydathodes along the upper margin, upper face convex, lower face flat, tip obtuse to acute; **Inf** several elongate dichasia ending in monochasia; peduncle indistinct; **Ped** 5 - 12 mm; **Sep** linear, to 3 mm, obtuse; **Cl** stellate, white, lobes shortly fused and reddish at the base, elliptic to spatulate; **Anth** yellow.

C. perfoliata Linné (Spec. Pl. [ed. 1], 282, 1753). **T:** OXF, PRE [photo]. – **D:** SE tropical Africa to RSA.

≡ *Larochea perfoliata* (Linné) Haworth (1821) ≡ *Rochea perfoliata* (Linné) De Candolle (1828).

C. perfoliata var. **coccinea** (Sweet) G. D. Rowley (Cact. Succ. J. Gr. Brit. 40(2): 53, 1978). – **D:** RSA (Eastern Cape); Valley Bushveld, flowers mid-summer.

≡ *Rochea perfoliata* var. *coccinea* Sweet (1830); **incl.** *Crassula johannis-winkleri* L. Lindinger (1938) (*nom. inval.*, Art. 36.1); **incl.** *Crassula perfoliata* var. *miniata* Tölken (1972) (*nom. illeg.*, Art. 52.1).

[19] Differs from var. *perfoliata*: **L** triangular-lanceolate, canaliculate; **Sep** 2 - 3 mm; **Cl** deep red, 5 - 7 mm.

C. perfoliata var. **heterotricha** (Schinz) Tölken (JSAB 41: 115, 1975). **T:** RSA, KwaZulu-Natal (*Rehmann* 7892 [Z]). – **D:** RSA (Eastern Cape, E Mpumalanga), SE Tropical Africa; subtropical thickets and savanna in dry river valleys among rocks, flowers mid-winter to early spring.

≡ *Crassula heterotricha* Schinz (1894).

[19] Differs from var. *perfoliata*: Smaller, to 40 cm; **L** erect, lanceolate, canaliculate at the base; **Sep** to 3 mm; **Cl** white, 5 - 7 mm; **Fl** and **Ca** pink.

C. perfoliata var. **minor** (Haworth) G. D. Rowley (Cact. Succ. J. Gr. Brit. 40(2): 53, 1978). – **D:** RSA

(Eastern Cape); Valley Bushveld in dry river valleys, flowers mid-summer. **I:** BCSJ 16: 51, 1998.

≡ *Larochea falcata* var. *minor* Haworth (1821) ≡ *Rochea falcata* var. *minor* (Haworth) De Candolle (1828); **incl.** *Crassula falcata* J. C. Wendland (1798) ≡ *Larochea falcata* (J. C. Wendland) Persoon (1805) ≡ *Rochea falcata* (J. C. Wendland) De Candolle (1828) ≡ *Crassula perfoliata* var. *falcata* (J. C. Wendland) Tölken (1975); **incl.** *Crassula retroflexa* Meerburgh (1798) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula falx* L. Lindinger (1936) (*nom. inval.*, Art. 36.1).

[19] Differs from var. *perfoliata*: **L** distinctly falcate, usually glaucous; **Cl** 7 mm long, red, pink or rarely white.

C. perfoliata var. **perfoliata** – **D:** RSA (Eastern Cape); dry Fynbos and Valley Bushveld, flowers spring to mid-summer. **Fig. IX.b**

Incl. *Larochea perfoliata* var. *alba* Haworth (1821) ≡ *Rochea perfoliata* var. *alba* (Haworth) Sweet (1830); **incl.** *Rochea falcata* var. *acuminata* Ecklon & Zeyher (1837); **incl.** *Crassula perfoliata* var. *albiflora* Harvey (1862); **incl.** *Crassula pallida* Baker (1874).

[19] Erect sparingly branched shrubs to 1.3 m tall; **R** fibrous; **Br** green, succulent, becoming woody in age; **L** 6 - 9.5 × 1.3 - 1.8 cm, decussate, ascending becoming spreading, lanceolate, slightly falcate, green, smooth, upper face flat, channelled at the base, margin acute towards the apex, truncate lower down, lower face convex, tip acute, mucronate; **Inf** rounded thyrses to 10 cm tall; peduncle 5 mm Ø, strigose; **Bra** L-like, lower 10 × 7 mm; **Fl** sweet-scented; **Ped** 1 mm; **Sep** 1 mm, triangular-lanceolate, reddish; **Cl** 3 - 4 mm, tubular below, stellate above; **Pet** becoming recurved, white.

C. perforata Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 319, 338, 1778). **T:** RSA, Eastern Cape (*Thunberg* 7779 [UPS, G-DC]). – **D:** RSA (Western Cape, Eastern Cape, KwaZulu-Natal); thickets, among rocks on cliffs and in crevices, flowers mid-summer to autumn.

Incl. *Crassula perfossa* Lamarck (1786); **incl.** *Crassula perfoliata* Scopoli (1788); **incl.** *Crassula anthurus* E. Meyer ex Drège (1844) (*nom. inval.*, Art. 32.1c); **incl.** *Crassula conjuncta* N. E. Brown (1902); **incl.** *Crassula patersoniae* Schönland (1910); **incl.** *Crassula nealeana* V. Higgins (1955).

[15] Spreading somewhat scrambling branched shrubs to 1 m tall; **R** fibrous; **Br** grey-brown, 3 mm Ø; **L** variable in size and shape, 14 - 33 × 12 - 20 mm, flattened, ovate, glabrous, grey-green, abruptly constricted at the base and fused with the opposite **L** of the pair, margins reddish, tips acute or obtuse; older **L** persistent; **Inf** elongated thyrses to 8 cm with sessile **Fl**; peduncle with gradual change from **L** to **Bra**; **Sep** triangular, to 1 mm, acute; **Cl** tubu-

lar, yellowish, lobes shortly fused at the base, oblong, to 2.5 mm; **Anth** brown.

C. phascoides (Grisebach) Bywater (KB 40(3): 537, ill., 1985). **T**: Argentina, Salta (*Lorentz & Hieronymus* 747 [GOET]). – **D**: N Argentina (Salta, Tucumán); high Andes, damp places.

≡ *Tristicha phascoides* Grisebach (1879); **incl.** *Crassula androsace* Sparre ex Rossow (1983).

[2] Minute ephemeral unbranched herbs 0.6 - 1.2 cm tall; **L** obovate, 1.5 - 3 × 0.5 - 1.8 mm, ciliate, acuminate; **Fl** 1 per node, 2- to 3-merous; **Ped** 3 - 4 (-6.5) mm; **Sep** ovate, 0.8 - 1.6 × 0.2 - 0.3 mm, acuminate; **Pet** ovate, 0.8 - 1.2 × 0.3 - 0.5 mm, tips with small appendages; **NSc** filiform-spatulate; **Se** 10 - 12 per **Ca**, oblong-rounded, ± 0.3 × 0.14 mm Ø, ± shiny with slight striations.

The very similar *C. closiana* has papillate sepals and seeds. When first described, the species was erroneously thought to belong to the *Podostemaceae*. – [U. Eggli]

C. planifolia Schönland (Rec. Albany Mus. 2: 142, 1907). **T**: RSA, Eastern Cape (*Pegler* 1454 [GRA, BM, BOL, K, PRE]). – **D**: RSA (Eastern Cape); mainly on dry slopes, flowers mid-winter to spring.

≡ *Creusa planifolia* (Schönland) P. V. Heath (1993).

[9] Erect moderately branched shrublets to 70 cm tall; young **Br** 2 mm Ø, green, bark becoming grey with age; older **Br** somewhat carnos, to 8 mm Ø; **L** 18 - 35 × 9 - 13 mm, lanceolate, spreading to recurved, both faces flat, tips acute; older **L** deciduous; **Inf** erect rounded lax thyrses to 10 cm tall and 5 cm Ø with numerous dichasia; peduncle to 6 cm, with 1 pair of **Bra**; **Ped** to 2 mm; **Sep** 1 mm, triangular, acute to obtuse; **Cl** cup-shaped, to 3 mm Ø, shortly tubular and lobes fused at the base, ovate-triangular, white; **Anth** black to brown.

C. plegmatoides H.-C. Friedrich (Mitt. Bot. Staatssamml. München 6: 627-629, 646, fig. 3a-k, 1967). **T**: Namibia (*Merxmüller & Giess* 2454 [M]). – **D**: S Namibia, N RSA (Northern Cape); Succulent Karoo, quartz gravel flats, sandy or rocky slopes, autumn-flowering. **I**: Tölken (1985: 210, fig. 20: 2).

Incl. *Crassula pseudocolumnaris* Dinter (1931) (*nom. inval.*, Art. 32.1c).

[18] Dwarf compact procumbent to erect sparingly branched herbs to 15 cm tall; **R** fibrous; **Br** 4 mm Ø with densely imbricate clasping **L** forming a neat quadrangular oblong **Bo** 10 - 25 mm Ø (sometimes stems only partly covered by the **L**), tapering towards the somewhat obtuse tip; **L** 6 - 12 × 5 - 10 mm, broadly ovate and fused at the bases, acute or obtuse, grey-green, upper face concave, lower face convex to somewhat cymbiform and keeled, epidermis papillate, margins minutely ciliate; **Inf** pedunculate rounded thyrses 2 × 2 cm; peduncle to 6 cm; **Sep** to 2 mm, triangular, acute or obtuse, margins

ciliate; **Cl** tubular, to 3 mm, cream or yellow, lobes oblong to oblong-oblancheolate, fused in the lower part, tips obtuse or acute; **Anth** brown.

Here belongs *C. arta* sensu Jacobsen etc., *non* Schönland (a synonym of *C. deceptor*).

C. pruinosa Linné (Mant. Pl., 60, 1767). **T** [lecto]: RSA, Western Cape (*Anonymus* s.n. [LINN 400.4]). – **D**: RSA (Western Cape); Fynbos, mountain tops on quartzitic sandstones, flowers in mid-summer.

Incl. *Crassula squamulosa* Schlechtendal (1814).

[10] Much-branched dwarf rounded shrublets to 20 cm tall; **R** fibrous; **Br** green at first, 1.5 mm Ø, with recurved coarse **Ha**, later glabrous and with brown bark; **L** 5 - 8 × 1 - 1.5 mm, ascending-spreading, linear-lanceolate, flattened to almost terete, covered with flattened appressed **Ha** with blunt apex and basally with 0 - 2 lateral points, upper face flat to convex, lower face markedly convex, tip acute with an elongate translucent **Ha**; **Inf** flat-topped to rounded thyrses to 1.2 × 2 cm with 1 to few dichasia; peduncle 1 - 3 cm; **Fl** almost sessile; **Sep** 2.5 - 4 mm, linear-lanceolate with appressed **Ha**, acute with dorsal elongated **Ha**; **Cl** white to cream, tubular, to 7 mm long in bud, lobes fused in the lower 1/3, ovate to oblanceolate, to 6 mm, spreading to recurved (**Fl** to 8 mm Ø when fully opened), with subterminal appendage; **Anth** dark brown.

C. pseudohemisphaerica H.-C. Friedrich (Mitt. Bot. Staatssamml. München 3: 589, 594-595, 1960). **T**: Namibia (*Dinter* 8095 [M, B, Z]). – **D**: S Namibia, RSA (Northern Cape, N Western Cape); Succulent Karoo, flowers spring to early summer. **Fig. X.a**

[14] Sparingly branched decumbent to erect compact herbs forming small clusters to 20 cm tall (when flowering); **R** fibrous; **L** 8 - 45 × 10 - 50 mm, flat, 4-ranked, obovate to orbicular, tightly imbricate and forming neat globose **Bo**, green to yellowish-green, spotted, margins ciliate, tip rounded; **Inf** terminal elongated thyrses with numerous dichasia; peduncle to 25 cm; **Sep** oblong-triangular, to 3 mm; **Cl** yellowish, tubular, to 5 mm; **Pet** shortly fused at the base, to 4 mm, oblong-oblancheolate, spreading and becoming recurved; **Anth** yellow.

C. pubescens Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 330, 340, 1778). **T**: RSA, Western Cape (*Thunberg* 7784a [UPS]). – **D**: RSA.

≡ *Globulea pubescens* (Thunberg) P. V. Heath (1995); **incl.** *Crassula higginsiana* hort. ex Bence (1975) (*nom. inval.*, Art. 34.1c).

C. pubescens ssp. **pubescens** – **D**: RSA (Western Cape); Succulent Karoo, spring-flowering. **I**: Tölken (1985: 217, fig. 21: 1). **Fig. IX.c**

Incl. *Sphaeritis biconvexa* Ecklon & Zeyher (1837) ≡ *Crassula biconvexa* (Ecklon & Zeyher)

Harvey (1862) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula fergusoniae* Schönland (1929); **incl.** *Crassula fergusoniae* fa. *major* Schönland (1929); **incl.** *Crassula radicans* var. *fastigiata* Schönland (1929); **incl.** *Crassula radicans* var. *phillipsii* Schönland (1929); **incl.** *Crassula fragilis* Schönland (1929) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula dewinteri* H.-C. Friedrich (1960).

[20] Dwarf branched decumbent pubescent herbs to 70 cm tall forming dense groups; **R** fibrous; **Br** succulent, green to reddish-green, becoming woody and grey-brown; **L** 15 - 35 × 5 - 12 mm, usually in basal **Ros**, flattened, spreading, oblanceolate, obovate to oblong-oblanceolate or oblong-obovate, pubescent, upper face flat to channelled, lower face convex, margin acute, minutely ciliate, base cuneate, tips obtuse to acute; **Inf** erect spike-like thyrses with 1 to several dichasia in the upper ½; peduncle with 1 - 3 pairs of **Bra**; lower **Bra** 5 × 4 mm, erect, triangular-ovate; **Sep** oblong, 1.5 mm; **Cl** tubular, white, lobes to 3 mm, oblong-panduriform, fused shortly at the base, with globose apical appendages.

C. pubescens ssp. **radicans** (Haworth) Tölken (JSAB 41: 115-116, 1975). **T** [neo]: RSA, Eastern Cape (*MacOwan* 836 [GRA, K, SAM]). – **D**: RSA (Eastern Cape); Valley Bushveld, spring-flowering.

≡ *Globulea radicans* Haworth (1827) ≡ *Crassula radicans* (Haworth) D. Dietrich (1840) ≡ *Globulea pubescens* var. *radicans* (Haworth) P. V. Heath (1995); **incl.** *Crassula radicans* var. *typica* Schönland (1929) (*nom. inval.*, Art. 24.3).

[20] Differs from ssp. *pubescens*: Forming dense mats; **Br** rooting when touching the ground; **Int** shorter, 2 - 10 mm; **L** oblanceolate, 6 - 30 × 2 - 5 mm, glabrous (rarely hairy); **Inf** rounded thyrses with 7 pairs of **Bra** below **Fl**; **Cl** lobes with ovoid to globose apical appendages.

C. pubescens ssp. **rattrayi** (Schönland & Baker *fil.*) Tölken (JSAB 41: 116, 1975). **T**: RSA, Eastern Cape (*Rattray* 30 [GRA]). – **D**: RSA (E Northern Cape, Eastern Cape); in the shelter of rocks, flowers spring to mid-summer.

≡ *Crassula rattrayi* Schönland & Baker *fil.* (1902) ≡ *Globulea pubescens* var. *rattrayi* (Schönland & Baker *fil.*) P. V. Heath (1995).

[20] Differs from ssp. *pubescens*: **L** in dense basal **Ros**, lateral **Br** not rooting; **Int** shorter, ± 10 mm or less; **L** obovate to oblanceolate, 15 - 40 × 8 - 20 mm, puberulous to velvety; **Inf** elongated thyrses with up to 7 pairs of **Bra** below the **Fl**; **Cl** lobes with ovoid to globose apical appendages.

C. pustulata Tölken (JSAB 38: 73, 1972). **T**: RSA, Western Cape (*Tölken* 4256 [BOL]). – **D**: RSA (Western Cape); Fynbos, flowers in mid-summer.

[10] Moderately branched herbs to 20 cm tall; **R** fibrous; **Br** green at first, 1 - 2 mm Ø, with re-

curved coarse **Ha**, later reddish-brown, with age becoming smooth and brown, old **L** and **Ha** persistent; **L** 5 - 14 × 1 - 2 mm, ascending-spreading, linear-lanceolate, subterete, green to grey-green, with ± flattened appressed **Ha**, these acute at the tip, basally with 2 lateral appendages, upper **L** slightly flattened; **Inf** flat-topped thyrses with 1 to few dichasia; **Sep** to 6 mm, green, linear-lanceolate, glabrous or with few appressed **Ha**, acute; **Cl** white to cream, tubular and to ± 10 mm long in bud, lobes fused shortly at the base, oblong-oblanceolate, to 10 mm, becoming recurved, with subterminal appendage; **Anth** brown.

C. pyramidalis Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 329, 336, t. 5b: fig. 3, 1778). **T**: RSA, Western Cape (*Thunberg* 7787 [UPS, LU, SJ]). – **D**: RSA (Western Cape, Eastern Cape); Succulent Karoo, dry Fynbos, Renosterveld, hill-tops on quartzitic sandstone, flowers in spring. **I**: Tölken (1985: 194, fig. 18: 3).

≡ *Purgosea pyramidalis* (Thunberg) G. Don (1834) ≡ *Tetraphyle pyramidalis* (Thunberg) Ecklon & Zeyher (1837); **incl.** *Tetraphyle quadrangula* Ecklon & Zeyher (1837) ≡ *Crassula quadrangula* (Ecklon & Zeyher) Endlicher *ex* Walpers (1843) ≡ *Tetraphyle pyramidalis* var. *quadrangula* (Ecklon & Zeyher) P. V. Heath (1993); **incl.** *Crassula pyramidalis* var. *ramosa* Schönland (1911); **incl.** *Crassula cylindrica* Schönland (1929) ≡ *Tetraphyle pyramidalis* var. *cylindrica* (Schönland) P. V. Heath (1993); **incl.** *Crassula archeri* Compton (1931) ≡ *Tetraphyle pyramidalis* var. *archeri* (Compton) P. V. Heath (1993).

[16] Erect to decumbent, sparingly branched, to 12 (-25) cm tall but variable in size; **R** fibrous; **Int** completely covered by the tightly clasping imbricate **L** in 4 ranks forming a neat quadrangular oblong **Bo** to ± 12 mm Ø, tapering at the obtuse tip; **L** green to brownish-green, triangular-ovate, 3 - 12 × 4 - 8 mm, flat, ascending, margin entire, tip bluntly acute; **Inf** dense terminal rounded cymose capitula, the basal part partly hidden by the **L**; **Sep** to 5 mm, oblong-oblanceolate, margin ciliate, tips obtuse; **Cl** tubular, ampulliform, to 14 mm, white or cream, lobes oblong elliptic, fused in the lower ⅓, tips with a blunt beak; **Anth** yellow.

C. goatlhambensis Hargreaves (Excelsa No. 15: 85, 1992). **T**: Lesotho, Botha Botha Distr. (*Hargreaves* 4955 [ROML]). – **D**: Lesotho; Afrotemperate highlands at 3000 m, on basalt rocks in grassland. **I**: Excelsa 14: 72.

[2?] Decumbent glabrous annuals; **Br** to 4.5 cm, 2.5 mm Ø, radiating from the central tap **R**; **L** to 5 × 2.5 mm, elliptic to oblong, green to reddish, with rows of minute papillae, upper face flat, lower face convex, tip acute or obtuse; **Inf** reduced thyrses with few dichasia; **Fl** 5-merous, pedicellate; **Sep** to 4 mm, lanceolate to oblong, minutely papillate, tips

obtuse to acute; **Cl** cup-shaped, white, to 10 mm Ø, lobes to 5 mm, broadly ovate, acute, spreading; **Anth** yellow.

Compared with *C. decumbens* in the protologue.

C. rhodesica (Merxmüller) Wickens & Bywater (KB 34(4): 632-633, 1980). **T:** Zimbabwe (*Hornby* 2911 [M, K, SRG]). – **D:** Namibia, Angola, Zimbabwe, Zambia, Tanzania, Kenya; mainly in shade, flowers in mid-summer to autumn.

≡ *Crassula pharnaceoides* ssp. *rhodesica* Merxmüller (1951) ≡ *Crassula campestris* ssp. *rhodesica* (Merxmüller) R. Fernandes (1978) ≡ *Combesia campestris* var. *rhodesica* (Merxmüller) P. V. Heath (1993).

[2] Erect to decumbent glabrous annual herbs; **R** fibrous; stems to 10 cm tall, sparingly branching with short lateral **Br** and elongate **Int**; **L** 4 - 10 × 1 - 3 mm, sessile, lanceolate to linear-triangular, glabrous, green to brown-green, lower face convex, margin entire, rarely denticulate at the base, tip subacute; **Inf** erect thyrses with numerous subsessile few-flowered (rarely >2) dichasia; **Fl** pedicellate (**Ped** elongating in fruit), 5-merous; **Sep** to 1.5 mm, linear-triangular to lanceolate, tip acute with a terminal awn; **Cl** cup-shaped, pale yellow, lobes to 0.8 mm, triangular-lanceolate, acute; **Anth** yellow.

C. rogersii Schönland (Rec. Albany Mus. 2: 149, 1907). **T:** RSA, Eastern Cape (*Rogers* s.n. [GRA, K]). – **D:** RSA (Eastern Cape); dry river valleys in thickets, flowers mid-summer to autumn.

≡ *Globulea rogersii* (Schönland) P. V. Heath (1995); **incl.** *Sedum canescens* var. *caulescens* Kuntze (1898).

[20] Branched decumbent to erect pubescent herbs to 15 cm tall forming small groups; **R** fibrous; **Br** succulent, green, older **Br** becoming woody and reddish-brown, 3.5 - 5 mm Ø, old **L** not persistent; **L** 15 - 23 × 7 - 13 mm, flattened, ascending and twisted sideways, oblanceolate, hairy, both faces convex, green to yellowish green, margin reddish, horny, base cuneate, tip obtuse to rounded; **Inf** elongated thyrses to 20 cm with several globose dichasia; **Sep** triangular, to 2.5 mm, obtuse, margin ciliate; **Cl** tubular, yellowish, lobes panduriform, to 4 mm, fused shortly at the base and with ovoid apical appendages.

C. roggeveldii Schönland (Trans. Roy. Soc. South Afr. 17: 183, 1929). **T** [lecto]: RSA, Northern Cape (*Marloth* 9910 [GRA]). – **D:** RSA (Northern Cape); Succulent Karoo, seasonally moist depressions, spring-flowering.

[2] Decumbent to procumbent glabrous (papillate when young) green to reddish annuals to 4 cm Ø; **R** fibrous; **L** 1 - 3 × 1 - 2 mm, flat, petiole to 3 mm, lamina obovate, upper face slightly convex, tip obtuse to truncate; **Inf** thyrses with 1 to few dichasia; **Ped** 3 - 5 mm; **Fl** 4-merous; **Cal** lobes broadly ovate, to

1.5 mm, obtuse; **Cl** cup-shaped, white, lobes ovate, to 2 mm, obtuse; **Anth** yellow.

C. ruamahanga A. P. Druce (New Zealand J. Bot. 25: 128, 1987). **T:** New Zealand, North Island (*Kirk* s.n. [WELT]). – **D:** New Zealand.

Incl. *Tillaea acutifolia* Kirk (1899) ≡ *Crassula acutifolia* (Kirk) A. P. Druce & Given (1984) (*nom. illeg.*, Art. 53.1).

[1] Delicate herbs to 3 cm in dense mats; **Br** filiform, **Int** to 1 cm; **L** 1.5 - 2 (-2.5) mm, thin, linear, acute to apiculate; **Fl** 4-merous, ± 1.5 mm Ø, sessile or subsessile; **Cal** deeply divided, **Sep** linear-lanceolate, acuminate; **Pet** shorter than the **Sep**, very narrowly ovate, acute to subacute, colour not described; **Nsc** minute; **Sty** recurved; **Se** 2 (-4?) per **Ca**.

Known only from very few specimens from one locality each from the North and South Island, respectively. – [U. Eggli]

C. rubricaulis Ecklon & Zeyher (Enum. Pl. Afric. Austral., 296, 1837). **T:** RSA, Eastern Cape (*Ecklon & Zeyher* 1892 [S, LE, SAM]). – **D:** RSA (Western Cape, Eastern Cape); Fynbos, rocky areas, flowers mid-winter.

Incl. *Crassula rubricaulis* var. *muirii* Schönland (1929).

[12] Small much-branched rounded shrubs to 40 cm tall; older **Br** becoming woody, younger **Br** reddish, becoming grey-brown, 4 mm Ø; **L** flat above, convex below, turning reddish, often crowded at the **Br** tips, 20 - 35 × 11 - 17 mm, oblanceolate to broadly obovate, margins acute, minutely ciliate, decurrent at the base, base cuneate, tip acute; **Inf** erect oblong to rounded thyrses, 12 - 29 cm, with several dichasia; peduncle reddish, 7 - 12 cm, 3 mm Ø; **Bra** ovate-lanceolate, 6 × 3 mm, becoming deciduous; **Ped** short, 1.5 - 2 mm; **Cl** 5 mm, white, stellate, to 7 mm Ø; **Sep** 3 mm, linear-lanceolate, reddish; **Pet** oblong, to 5 mm, fused shortly at the base, becoming recurved.

C. rudolfii Schönland & Baker *fil.* (J. Bot. 36: 363, 1898). **T:** RSA, Northern Cape (*Schlechter* 11118 [GRA, BM, K, Z]). – **D:** Namibia, RSA (Northern Cape); Succulent Karoo, spring-flowering.

[10] Much-branched spreading subshrubs to 80 cm tall; **R** fibrous; **Br** with recurved **Ha**, becoming glabrous, old with flaking bark; **L** 8 - 20 × 2 - 3 mm, ascending-spreading, glaucous- to brownish-green, old deciduous, linear-lanceolate, flattened, minutely papillate, upper face flat to convex, lower face markedly convex, margin ciliate, tip acute; **Inf** rounded thyrses with several dichasia; **Sep** triangular-lanceolate, to 2 mm, minutely papillate and with recurved marginal cilia; **Cl** urceolate to tubular, lobes fused shortly at the base, white to cream, to 4 mm, lorate to subpanduriform, tips obtuse with dorsal appendages; **Anth** black.

C. rupestris Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 329, 337, 1778). **T:** RSA, Northern Cape (Thunberg 7792 [UPS]). – **D:** Namibia, RSA.

C. rupestris ssp. **commutata** (H.-C. Friedrich) Tölken (JSAB 41: 116, 1975). **T:** Namibia (*Merxmüller & Giess* 3499 [M]). – **D:** S Namibia, RSA (Northern Cape); Succulent Karoo among rocks, flowers spring to mid-summer.

≡ *Crassula commutata* H.-C. Friedrich (1967).

[15] Differs from ssp. *rupestris*: Young **Br** 1 mm Ø; **L** smaller, those of a pair only fused for a very short part, broadly ovate and very succulent, cymbiform, 7 - 10 × 6 - 8 mm; **Inf** almost sessile.

Here belongs *C. brevifolia* in the sense of horticulture.

C. rupestris ssp. **marnieriana** (H. Huber & H. Jacobsen) Tölken (JSAB J. South Afr. Bot. 41: 116, 1975). **T** [neo]: RSA, Western Cape (*Esterhuysen* 25949 [BOL]). – **D:** RSA (Western Cape); Succulent Karoo among rocks, flowers autumn to mid-winter.

≡ *Crassula marnieriana* H. Huber & H. Jacobsen (1951).

[15] Differs from ssp. *rupestris*: Smaller; **Br** spreading, rooting at the nodes; **Int** short and ± invisible; **L** of a pair fused into a roundish disk with obtuse tips; **L** to 9 × 16 mm, tips with a red mucro.

C. rupestris ssp. **rupestris** – **D:** RSA (Western Cape, Eastern Cape); Succulent Karoo among rocks, flowers mid-winter to spring. **Fig. IX.d**

Incl. *Crassula punctata* Miller (1768) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula monticola* N. E. Brown (1882).

[15] Rounded much branched succulent shrubs to 4 m tall; **R** fibrous; **Br** green, 2 mm Ø, older **Br** grey-brown, to 5 mm Ø with peeling bark; **L** 13 - 18 × 10 - 15 mm, flattened, upper face flat to convex but concave towards the base, lower face convex, lamina broadly ovate, glabrous, grey-green with powdery bloom, constricted at the base and basally fused with the opposite **L** of the pair, margin entire, reddish, tip acute or obtuse; **Inf** rounded thyrses with numerous dichasia; peduncle to 2 cm; **Bra** spreading, to 3 mm; **Sep** oblong-triangular, to 1 mm; **Cl** tubular, yellowish, lobes shortly fused at the base, oblong, to 4 mm; **Anth** brown.

C. saginoides (Maximowicz) Bywater & Wickens (KB 39(4): 708, ill. (p. 709), 1984). **T:** Mongolia (*Potanin* s.n. [LE, K]). – **D:** N America (Alaska to Mexico), Hispaniola, C Asia; naturalized in Portugal; terrestrial to subaquatic, to 3000 m.

≡ *Tillaea saginoides* Maximowicz (1880); **incl.** *Tillaea simplex* Philippi (1872) (*nom. illeg.*, Art. 53.1); **incl.** *Tillaea angustifolia* var. *bolanderi* S.

Watson (1876) ≡ *Tillaea bolanderi* (S. Watson) Greene (1891) ≡ *Tillaea drummondii* var. *bolanderi* (S. Watson) Jepson (1901); **incl.** *Tillaeastrum pringlei* Rose (1903).

[1] Erect to decumbent herbs to 13.5 cm; **L** elliptic-oblongate, 2 - 5 mm, acute; **Fl** 1 per node, 4-merous; **Ped** extending in **Fr**, (0.5-) 2 - 19 mm; **Sep** triangular to obtuse, 0.9 - 1.3 × 0.4 - 0.9 mm, with occasional black glandular dots; **Pet** oblong to ovate, 1.3 - 1.9 × 0.5 - 0.7 mm, longer than the **Sep**; **NSc** filiform-spatulate, 0.9 mm; **Se** (6-) 8 - 10 (-17) per **Ca**, oblong-ellipsoid, 0.39 - 0.42 × 0.14 - 0.2 mm, reddish-brown, longitudinally striate. – [U. Eggli]

C. sarcocaulis Ecklon & Zeyher (Enum. Pl. Afric. Austral., 295, 1837). **T:** RSA, Eastern Cape (*Ecklon & Zeyher* 1884 [GRA, S]). – **D:** S Africa.

≡ *Creusa sarcocaulis* (Ecklon & Zeyher) P. V. Heath (1993).

C. sarcocaulis ssp. **rupicola** Tölken (JSAB 41: 116, 1975). **T:** RSA, KwaZulu-Natal (*Killick* 1371 [BOL, K, NH, PRE]). – **D:** Lesotho, Malawi, Zimbabwe, RSA (Northern Prov., KwaZulu-Natal, Mpumalanga: Drakensberg Range); Afro-temperate grassland in shallow soil on rocks, flowers autumn to mid-winter. **Fig. IX.a, IX.e**

≡ *Creusa sarcocaulis* ssp. *rupicola* (Tölken) P. V. Heath (1993); **incl.** *Sedum caffrum* Kuntze (1898); **incl.** *Crassula sarcocaulis* var. *mlanjiana* R. Fernandes (1978).

[9] Differs from ssp. *sarcocaulis*: Main stem to 5 cm Ø; **L** 6 - 25 × 1.5 mm, linear to linear-elliptic, sometimes with slightly revolute margins; young **L** often with **Ha**-like papillae.

The plants are highly variable in leaf length. The following cultivar has been recognized:

'Valley of Desolation': Plants rounded, 16 × 16 cm, main stem to 1 cm Ø; **L** 5 × 1.5 mm, linear-elliptic; **Inf** short dense terminal thyrses 1 cm tall; **Sep** linear-triangular, glandular-pubescent, to 1.5 mm; **Cl** 5 × 2 mm Ø, pink. The plants are very floriferous and showy with *Erica*-like flowers.

C. sarcocaulis ssp. **sarcocaulis** – **D:** Lesotho, Zimbabwe, RSA (Northern Prov., Mpumalanga, KwaZulu-Natal: Drakensberg Range); Afro-temperate grasslands in shallow soil on rocks, flowers autumn to mid-winter.

Incl. *Crassula sarcocaulis* var. *scaberula* Harvey (1862); **incl.** *Crassula parvisepala* Schönland (1897); **incl.** *Crassula lignosa* Burt Davy (1926).

[9] Erect densely branched shrublets with a spreading tree-like crown to 60 cm tall and ± as broad; young **Br** 2 mm Ø, green, with **Ha**-like papillae; older **Br** glabrous, sometimes with brown peeling flakes exposing the grey bark, to 2.5 cm Ø at base; **L** variable in shape and size, 15 - 35 × 4 - 10 mm, ovate to lanceolate, ascending-spreading,

both faces flat, margin with a ring of hydathodes, tips acute; older **L** deciduous; **Inf** rounded thyrses 1 - 1.5 cm tall and 1 - 2.5 cm Ø, with numerous dichasia; peduncle indistinct; **Ped** 2 - 4 mm; **Sep** to 2 mm, triangular, acute; **Cl** cup-shaped, 3 × 2 mm Ø, shortly tubular, lobes fused at the base, ovate-triangular, white, pink or cream; **Anth** brown.

C. sarmentosa Harvey (FC 2: 348, 1862). **T:** RSA, KwaZulu-Natal (*Drège* s.n. [S]). – **D:** RSA.

≡ *Septimia sarmentosa* (Harvey) P. V. Heath (1993).

C. sarmentosa var. *integrifolia* Tölken (JSAB 41: 117, 1975). **T:** RSA, KwaZulu-Natal (*Strey* 7630 [NH, K, PRE]). – **D:** RSA (S KwaZulu-Natal); grassland and savanna, flowering mid-winter to spring.

≡ *Septimia multicava* var. *integrifolia* (Tölken) P. V. Heath (1993).

[6] Differs from var. *sarmentosa*: **L** elliptic, margins entire; **Fl** erect.

C. sarmentosa var. *sarmentosa* – **D:** RSA (Western Cape, KwaZulu-Natal), naturalized in Australia (New South Wales); Afro-temperate and subtropical forest in shade, flowers in mid-summer.

Incl. *Crassula ovata* E. Meyer ex *Drège* (1844) (*nom. inval.*, Art. 32.1c).

[6] Procumbent, mat-forming to scrambling and to ± 40 cm tall; **R** fibrous; **Br** terete, reddish-pink to green, mottled with white, to 1 m long, to 6 mm Ø; **Int** 1 - 2.5 cm; **L** petiolate to 3 mm, flat, 20 - 55 × 10 - 35 mm, ascending, light green, ovate, elliptic to lanceolate, margins serrate, reddish to green with a ring of hydathodes, base rounded, cuneate to somewhat cordate, tip acute or acuminate; **Inf** terminal thyrses ending in few dichasia, to 5 × 5 cm; **Ped** to 5 mm; **Fl** spreading at right angles to one another; **Sep** to 3 mm, linear-triangular, glabrous, acute; **Cl** stellate, white tinged pink, to 10 mm Ø; **Pet** lanceolate, to 4 × 1 mm, lower face often dark pink; **Anth** pale pink to white.

C. saxifraga Harvey (FC 2: 357, 1862). **T:** RSA, Western Cape (*Ecklon & Zeyher* 1862 [S, SAM]). – **D:** RSA (Northern Cape, Western Cape, Eastern Cape); flats and slopes, usually in Renosterveld, flowers autumn to mid-winter. **I:** Tölken (1985: 140, fig. 15: 1).

≡ *Septas saxifraga* (Harvey) P. V. Heath (1993).

[7] Geophytes with erect unbranched stems to 15 cm; rhizome branched with several globose tubers with fibrous adventitious **R**; **L** in 1 - 2 pairs, 1 - 5 × 3 - 12 cm, flattened, transversely obovate, sessile, margin crenate to doubly crenate, surface glabrous, green, rarely purplish below, tip obtuse to subacute; **Inf** terminal umbellate thyrses; peduncle to 25 cm; **Sep** triangular, to 3 mm; **Cl** 5-merous, tubular, white, tinged pink, lobes oblanceolate, to 7.5 mm,

tips subacute to rounded, spreading to recurved; **Anth** brown.

C. scabra Linné (Spec. Pl. [ed. 1], 283, 1753). **T:** [lecto – icono]: Dillenius, Hort. Eltham., t. 99: fig. 117, 1732. – **D:** RSA (Western Cape); Fynbos and Renosterveld, flowers in mid-summer.

[10] Sparsely branched herbs to 40 cm tall; **R** fibrous; **Br** green at first, 1 - 2 mm Ø, with recurved coarse **Ha**, later with reddish-brown bark turning brown with age; old **L** and **Ha** persistent; **L** 10 - 35 × 2 - 5 mm, ascending-spreading, linear-lanceolate to triangular-lanceolate, flattened, green to grey-green, with ± flattened appressed translucent rod-like **Ha** which are acute at one end, upper face flat to concave to slightly convex, lower face markedly convex, apex acute; **Inf** flat-topped to rounded thyrses to 1.2 × 2 cm with 1 to few dichasia; peduncle 1 - 3 cm; **Fl** shortly pedicellate to almost sessile; **Sep** to 6 mm, green, linear-lanceolate, with few appressed **Ha**, tip acute with dorsal short **Ha**; **Cl** white to cream, tubular, to ± 10 mm long in bud, lobes fused shortly at the base, oblong-oblanceolate, to 10 mm, becoming recoiled, with subterminal appendage; **Anth** brown.

C. schimperi Fischer & C. A. Meyer (Index Sem. Hort. Petrop. 8: 56-57, 1842). **T:** Ethiopia (*Schim-per* 183 [LE, K]). – **D:** E Africa, Asia.

≡ *Tillaea schimperi* (Fischer & C. A. Meyer) M. G. Gilbert & al. (2000).

C. schimperi ssp. *phyturus* (Mildbraed) R. Fernandes (Bol. Soc. Brot., sér. 2, 52: 172, 1978). **T:** Kenya (*Lindblom* s.n. [S]). – **D:** Ethiopia, Sudan, Uganda, Tanzania, Kenya, Socotra; grassland, heath or forest, seasonally moist but exposed sites, 1500 - 4100 m. **I:** Wickens (1987: 9).

≡ *Crassula phyturus* Mildbraed (1922) ≡ *Crassula pentandra* var. *phyturus* (Mildbraed) Hedberg (1957) ≡ *Combesia phyturus* (Mildbraed) P. V. Heath (1993) ≡ *Tillaea schimperi* ssp. *phyturus* (Mildbraed) M. G. Gilbert & al. (2000); **incl.** *Crassula pentandra* var. *obtusifolia* Engler (1892); **incl.** *Crassula parvifolia* E. A. Bruce (1932).

[2] Differs from ssp. *schimperi*: *Lycopodium*-like herbs (rarely erect); **L** thick-textured, obtuse, base not spurred, hydathodes large and conspicuous. – [U. Eggli]

C. schimperi ssp. *schimperi* – **Lit:** Gilbert & al. (2000). **D:** Uganda, Kenya, Tanzania, Yemen, Bhutan, China, India, Nepal, Pakistan; moist but well-drained and often shaded sites, rarely epiphytic, (1500-) 2000 - 4800 m. **I:** Gilbert (1989: 7).

Incl. *Tillaea pentandra* Royle ex Edgeworth (1846) ≡ *Disporocarpa pentandra* (Royle ex Edgeworth) Ascherson & Schweinfurth (1867) (*nom. inval.*, Art. 43.1) ≡ *Crassula pentandra* (Royle ex Edgeworth) Schönland (1890); **incl.** *Crassula tibes-*

tica de Mire & Quézel (1961) (*nom. inval.*, Art. 36.1); **incl.** *Crassula schimperi* fa. *abbreviata* R. Fernandes (1978).

[2] Perennial erect or sprawling herbs, stem succulent to woody at the base, to 5 mm Ø with dark brown to reddish irregularly peeling bark; dead **L** usually persistent; **L** sessile, lanceolate to ovate, linear or triangular, to 12 × 3 mm, thin-textured, acute, sometimes setose, base spurred, those of a pair united to a sheath to 2 mm high, hydathodes small and often inconspicuous; **Inf** condensed axillary cymes rarely exceeding the subtending **L**; **Fl** (1-) 3 - 12, (4- to) 5-merous; **Ped** short; **Sep** narrowly triangular, to 1.8 × 0.3 mm, longer or slightly shorter than the whitish, yellowish or pink **Pet**; **Ca** 0.7 - 1 mm, contracted or attenuate; **Se** 2 per **Ca**, oblong-ovoid, ± 0.5 × 0.3 mm.

The relationship with *C. lanceolata* ssp. *lanceolata* needs further investigation, but Tölken's inclusion as a synonym appears premature. – [U. Eggli]

C. schmidtii Regel (Gartenflora 35: 345-346, t. 1225, 1886). **T:** LE.

Incl. *Crassula impressa* N. E. Brown (1870) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula schmidtii* fa. *alba* Boom (1952).

Very similar to *C. exilis* ssp. *cooperi* and perhaps representing a horticultural form of it. It does, however, not agree with any form recorded from nature and differs by more erect follicles (Tölken 1985: 229). It is widely cultivated for its small red flowers, and a white-flowering form was distributed as fa. *alba*. – [U. Eggli]

C. sebaeoides (Ecklon & Zeyher) Tölken (JSAB 41: 118, 1975). **T:** RSA, Western Cape (Ecklon & Zeyher 1936 [K, LE, S]). – **D:** RSA (E Western Cape); spring-flowering.

≡ *Grammanthes sebaeoides* Ecklon & Zeyher (1837) ≡ *Grammanthes gentianoides* var. *sebaeoides* (Ecklon & Zeyher) Harvey (1862) ≡ *Dinacria sebaeoides* (Ecklon & Zeyher) Schönland (1897); **incl.** *Grammanthes flava* E. Meyer ex Drège (1843) (*nom. inval.*, Art. 32.1c); **incl.** *Grammanthes gentianoides* var. *media* Harvey (1862).

[3] Erect glabrous branched annuals to 8 cm tall; **L** 5 - 12 × 2 - 4 mm, flat, lanceolate to elliptic, green, somewhat cymbiform, tip obtuse; **Inf** thyrses with mostly a solitary dichasium; **Cal** lobes to 2 mm, elliptic, obtuse; **Cl** tubular, lobes shortly fused at the base, yellow, oblanceolate, to 5 mm, acute; **Anth** yellow; **Sti** lateral.

C. sediflora (Ecklon & Zeyher) Endlicher ex Walpers (Repert. Bot. Syst. 2: 254, 1843). **T:** RSA, Eastern Cape (Ecklon & Zeyher 1909 [S, LE, SAM, TCD]). – **D:** RSA.

≡ *Purgosea sediflora* Ecklon & Zeyher (1837).

C. sediflora var. *amatolica* (Schönland) Tölken

(JSAB 41: 118, 1975). **T:** RSA, Eastern Cape (Dyer 356 [GRA, K, LU, PRE]). – **D:** RSA (Eastern Cape); grassland, rocky outcrops, flowers in mid-summer.

≡ *Crassula amatolica* Schönland (1929).

[14] Differs from var. *sediflora*: **Br** decumbent, to 30 cm tall; **Int** 2 - 4 mm; **L** linear-triangular, 4 - 8 × 2 - 4 mm, margin ciliate.

C. sediflora var. *sediflora* – **D:** RSA (KwaZulu-Natal to Eastern Cape); shallow rocky soil or rock faces, flowers mid-summer to autumn.

Incl. *Crassula tenuifolia* Schönland (1897).

[14] Decumbent branched perennials to 40 cm tall; **Int** 4 - 15 mm; **L** 4 - 25 × 1 - 4 mm, linear, **L** pairs spirally arranged, flattened, slightly papillose, green to yellowish-green, margin papillate becoming smooth, tip acute; **Inf** erect terminal round-topped thyrses with 1 to many dichasia; **Bra** **L**-like becoming shorter upwards; **Fl** shortly pedicellate, laxly arranged; **Sep** to 2 mm, broadly triangular, glabrous; **Cl** tubular, cream to white, to 3 mm; **Pet** oblong-oblanceolate, to 2.5 mm, fused shortly at the base, tips rounded and slightly cucullate, recurved; **Anth** yellow.

C. sericea Schönland (BJS 45: 254, 1910). **T:** RSA, Northern Cape (Schlechter 11436 [GRA]). – **D:** Namibia, RSA.

C. sericea var. *hottentotta* (Marloth & Schönland) Tölken (JSAB 41: 118, 1975). **T:** RSA, Northern Cape (Marloth 12506 [GRA, PRE]). – **D:** S Namibia, RSA (Northern Cape); Succulent Karoo, flowers from winter to early spring. **I:** Tölken (1985: 203, fig. 19: 6a).

≡ *Crassula hottentotta* Marloth & Schönland (1929); **incl.** *Crassula merxmuelieri* H.-C. Friedrich (1960).

[17] Differs from var. *sericea*: More robust, with round papillae on stems and **L**; **Br** short, stout, to 11 cm, 5 mm Ø with 8 - 10 pairs of firm spreading very succulent **L**; **Int** 5 - 8 mm; **L** lamina triangular to triangular-ovate, 20 - 30 × 13 - 20 mm, flattened, fleshy, to 7 mm thick, upper face flat to ± concave, lower face keeled; **Inf** erect thyrses, 3 - 9.5 cm, with dense spreading glomerate dichasia 8 - 10 mm Ø; peduncle 2 - 5.5 cm; **Sep** ovate, 1 mm; **Cl** 3 mm, dull yellow, tubular, lobes oblong, ± 2 mm, fused at the base.

C. sericea var. *sericea* – **D:** S Namibia, RSA (Northern Cape); Succulent Karoo. **I:** Tölken (1985: 203, fig. 19: 5).

Incl. *Crassula klinghardtensis* Schönland (1929); **incl.** *Crassula suavis* H.-C. Friedrich (1974); **incl.** *Crassula hallii* Adcock (1976) (*nom. inval.*, Art. 36.1, 37.1).

[17] Much-branched, forming rounded spreading tufts 6 × 20 cm; **L** (broadly) obovate, oblanceolate

to elliptic, 10 - 25 × 10 - 25 mm, flattish, upper face flat to convex, lower face convex, margin reddish towards tips, lamina grey-green with spreading **Ha**, base cuneate, tip obtuse to acute; **Inf** elongated thyrses 4 - 10 cm with few to many dichasia; peduncle hairy, purplish, 2 mm Ø at the base; **Bra** triangular, clasping, 2 mm; **Sep** triangular-lanceolate, 1 mm; **Cl** tubular, 4 × 2 mm, lobes 3 × 1.3 mm, oblanceolate, ascending-spreading, white; **Anth** brown.

C. sericea var. **velutina** (H.-C. Friedrich) Tölken (JSAB 41: 118, 1975). **T**: RSA, Northern Cape (*Herre* s.n. in *SUG* 7978 [M, PRE]). – **D**: S Namibia, RSA (Northern Cape); Succulent Karoo, flowers from winter to early spring. **I**: Tölken (1985: 203, fig. 16: 2).

≡ *Crassula velutina* H.-C. Friedrich (1967).

[17] Differs from var. *sericea*: Plants smaller, decumbent to erect, sparingly branched, to 15 cm tall (incl. **Inf**); **Br** short, to 6.5 cm tall, with 8 - 10 pairs of ascending **L**; **Int** 5 - 10 mm; **L** obovate to broadly ovate, 20 - 30 × 10 - 20 mm, flattened, fleshy, to 5 mm thick, upper face flat to somewhat concave, lower face convex, surface with erect to spreading dense white **Ha**, tip obtuse, often mucronate; **Inf** erect thyrses to 10 × 9 cm with spreading glomerate dichasia 8 - 10 mm Ø; peduncle reddish, 2 - 6 cm; **Sep** triangular, 1 mm; **Cl** 3 mm, white, tubular, lobes oblong, ± 2 mm, acuminate, recurved, without dorsal appendages.

C. setulosa Harvey (FC 2: 347, 1862). – **D**: RSA, Lesotho.

C. setulosa var. **deminuta** (Diels) Tölken (JSAB 41: 118-119, 1975). **T**: RSA, Mpumalanga (*Wilms* 515 [B †, K]). – **D**: RSA (Mpumalanga); grassland in shallow rock pockets, flowers in mid-summer.

≡ *Crassula deminuta* Diels (1907).

[14] Differs from var. *setulosa*: **L** erect, 6 - 12 × 2 - 6 mm, lanceolate to elliptic-oblanceolate, glabrous, margin ciliate, upper face flat, lower face convex; **Inf** terminal spike-like thyrses; **Sep** triangular; **Pet** oblanceolate; **Anth** brown.

C. setulosa var. **jenkinsii** Schönland (Trans. Roy. Soc. South Afr. 17: 239, 1929). **T**: RSA, Gauteng (*Jenkins* s.n. in *TRV* 10369 [GRA]). – **D**: RSA (Gauteng, Northern Prov.); grassland in shallow rock pockets and crevices, autumn-flowering.

≡ *Crassula jenkinsii* (Schönland) Hort. München (s.a.) (*nom. inval.*, Art. 29.1).

[14] Differs from var. *setulosa*: **L** irregularly arranged, erect, 5 - 25 × 3 - 7 mm, lanceolate or linear-lanceolate, lamina glabrous or with few erect cilia, upper face flat to somewhat channelled, lower face markedly convex; **Inf** terminal cymes with up to 5 **Fl**; **Sep** linear-triangular; **Pet** oblong to oblong-oblanceolate; **Anth** dark purple to black.

C. setulosa var. **longiciliata** Tölken (JSAB 41: 119, 1975). **T**: RSA, Northern Prov. (*Galpin* 13622 [BOL, K, PRE]). – **D**: Lesotho, RSA (Northern Prov., Mpumalanga, KwaZulu-Natal); grassland in shallow rock pockets and crevices in moist places, flowers mid-summer to autumn.

[14] Differs from var. *setulosa*: **Br** woody, to 15 cm, in winter with rosulate buds; **L** 3 - 10 × 1.5 - 3 mm, elliptic-oblong to oblanceolate, glabrous, margin distinctly ciliate, upper face flat, lower face convex; **Inf** terminal flat-topped thyrses; **Sep** triangular; **Pet** oblong-oblanceolate with rounded tips; **Anth** yellow.

C. setulosa var. **rubra** (N. E. Brown) G. D. Rowley (Cact. Succ. J. Gr. Brit. 40(2): 53, 1978). **T**: RSA, KwaZulu-Natal (*Wood* 4592 [K]). – **D**: Lesotho, RSA (Eastern Cape, KwaZulu-Natal); grassland in shallow rock pockets, flowers mid-summer to autumn.

≡ *Crassula curta* var. *rubra* N. E. Brown (1895); **incl.** *Crassula curta* N. E. Brown (1895) ≡ *Crassula setulosa* var. *curta* (N. E. Brown) Schönland (1929); **incl.** *Sedum dregeanum* var. *erectum* Kuntze (1898); **incl.** *Crassula barklyana* Schönland (1907); **incl.** *Crassula milfordiae* Byles (1957).

[14] Differs from var. *setulosa*: **L** spreading, forming cup-shaped **Ros**, 6 - 13 × 1 - 3 mm, tips obtuse, lamina glabrous with few cilia towards the base; **Inf** terminal flat-topped thyrses; **Sep** linear-triangular; **Anth** yellow.

C. setulosa var. **setulosa** – **D**: Lesotho, RSA (Gauteng, Northern Prov., Mpumalanga, Free State, KwaZulu-Natal), Swaziland; grassland in shallow rock crevices and pockets, flowers in mid-summer.

Incl. *Crassula stachygera* var. *pulchella* Harvey (1862); **incl.** *Sedum dregeanum* var. *adscendens* Kuntze (1898); **incl.** *Crassula scheppigiana* Diels (1907); **incl.** *Crassula setulosa* var. *ramosa* Schönland (1907); **incl.** *Crassula ramuliflora* var. *transvaalensis* Schönland (1929); **incl.** *Crassula setulosa* var. *basutica* Schönland (1929); **incl.** *Crassula setulosa* var. *lanceolata* Schönland (1929); **incl.** *Crassula setulosa* var. *ovata* Schönland (1929); **incl.** *Crassula bloubergensis* R. A. Dyer (1966); **incl.** *Crassula setulosa* fa. *latipetala* R. Fernandes (1978).

[14] Rosulate, proliferating from the base to form dense clusters to 25 cm tall (incl. **Inf**); **R** fibrous; **L** 10 - 30 × 6 - 14 mm, flat, elliptic, broadly elliptic to ovate-lanceolate, recurved and in a tight **Ros** (when exposed to sun) at first, becoming more lax at flowering, upper face flat to slightly channelled, lower face convex, variable in colour and vestiture, green to reddish when exposed, with recurved **Ha** to glabrous, margin ciliate, base cuneate, tip acute; **Inf** terminal round-topped thyrses with 1 to few dichasia; **Fl** sessile; **Sep** to 3 mm, triangular, margin ciliate, tips with apical sturdy **Ha**; **Cl** white, tubular, to 4

mm; **Pet** oblong-lanceolate, to 3.5 mm, fused shortly at the base, spreading to recurved, tips acute; **Anth** yellow to brown.

C. sieberiana (Schultes) Druce (Bot. Soc. Exch. Club Brit. Isles 1916: 704, 1917). **T:** Australia (Sieber 173 [M, G-DC, K, LE, MEL]). – **D:** Australia, New Zealand.

≡ *Tillaea sieberiana* Schultes (1827); **incl.** *Tillaea pedunculata* Siebthorp ex Schultes (1827) (*nom. inval.*, Art. 34.1c).

C. sieberiana ssp. **rubinea** Tölken (J. Adelaide Bot. Gard. 6(2): 193-194, ill., 1983). **T:** Australia, New South Wales (Telford 8676 [CBG, AD, CHR, K, L, MO, NSW]). – **D:** Australia (New South Wales: vicinity of Nerriga); shallow soil on top of sandstone shelves.

[2] Differs from ssp. *sieberiana*: Perennial tufts, branched mainly basally with swollen nodes, **Br** rarely rooting; basal **Int** 2 - 4 (-5) mm; **L** ruby-red, sheath (0.4 -) 0.5 - 0.7 mm; **Pet** ± as long as the **Sep**. – [U. Eggli]

C. sieberiana ssp. **sieberiana** – **D:** SE Australia incl. Tasmania and Lord Howe Island, New Zealand; crevices of wet rocks in mountains. **I:** Tölken (1981: 64, fig. 3: F-H). **Fig. X.b**

Incl. *Tillaea muscosa* Forster fil. (1786) (*nom. illeg.*, Art. 53.1); **incl.** *Tillaea verticillaris* De Candolle (1828) (*nom. illeg.*, Art. 52.1).

[2] Small perennials (rarely annuals); **Br** decumbent, to 20 cm, rooting at the nodes, ± fleshy and with swollen nodes; **Int** (1-) 3 - 5 (-8) mm; **L** linear-lanceolate, (3-) 4 - 8 (-11) × 1 - 3 mm, acute to obtuse, green to greyish-brown, usually flattish, upper face flat, lower face convex, sheath 0.2 - 0.3 (-0.4) mm; **Inf** 1 to several thyrses (rarely panicles) usually with many pairs of sessile dichasia in the **Ax** of **L**-like **Bra**; **Fl** 4-merous (5-merous in Queensland); **Ped** 1 - 10 mm at **Fr** stage; **Sep** (linear-) lanceolate, 1.5 - 3 mm, tip colourless; **Cl** cup-shaped, pale yellow to red; **Pet** lanceolate, 1 - 2 mm, acute, often folded lengthwise, $\frac{2}{3}$ as long as the **Sep**; **NSc** linear-cuneate to oblong T-shaped; **Se** 2 per **Ca**, ± smooth with faint longitudinal ridges or rarely minutely tuberculate; both **Se** normally released through an apical or lateral slit or pore. – [U. Eggli]

C. sieberiana ssp. **tetramera** Tölken (J. Adelaide Bot. Gard. 3(1): 77-78, ill. (p. 64), 1981). **T:** Australia, Northern Territory (Latz 4286 [AD, CANB, NT]). – **D:** Australia incl. Tasmania; ecologically variable.

≡ *Crassula tetramera* (Tölken) A. P. Druce & W. R. Sykes (1987).

[2] Differs from ssp. *sieberiana*: Annuals; **Br** erect or rarely decumbent, to 15 cm, not rooting, wiry, basal **Int** (4-) 8 - 12 (-20) mm; **Fr** releasing the upper **Se** through an apical pore while the basal

Se (remaining enclosed in the pale brown pericarp) is shed with a basal circumscissile split. – [U. Eggli]

C. simulans Schönland (Trans. Roy. Soc. South Afr. 17: 204, 1929). **T:** RSA, Western Cape (*Leipoldt* s.n. in *BOL* 18525 [GRA, K, BOL]). – **D:** RSA (Western Cape); mountains, quartzitic sandstones, in shade, spring-flowering.

≡ *Septas simulans* (Schönland) P. V. Heath (1993).

[7] Geophytes with erect unbranched stems to 15 cm; tuber globose with fibrous adventitious **R**; **L** in 3 - 4 pairs, 15 - 40 × 5 - 20 mm, flattened, elliptic to obovate, margin crenate, surface glabrous; petiole to 1 cm; **Inf** terminal thyrses; peduncle to 6 cm; **Sep** triangular-lanceolate, to 1.5 mm, acute to obtuse; **Cl** stellate, to 8 mm Ø, yellowish-green, lobes lanceolate, to 3.5 mm; **Anth** yellow.

C. sinclairii (Hooker fil.) A. P. Druce & Given (New Zealand J. Bot. 22(4): 583, 1984). **T:** New Zealand (*Sinclair* s.n. [K]). – **D:** New Zealand; montane damp places.

≡ *Tillaea sinclairii* Hooker fil. (1864); **incl.** *Tillaea novae-zelandiae* Petrie (1893).

[1] Small delicate herbs to 3 cm in dense cushions; stems with **Int** < 5 mm; **L** 1 - 2 mm, thin, linear-subulate to linear-oblong, subacute to acute; **Fl** 4-merous, ± 1.5 mm Ø, shortly pedicellate; **Cal** deeply lobed, **Sep** ovate-oblong, obtuse; **Pet** 2× as long as the **Sep**, white, oblong, obtuse; **Sty** very short, slightly recurved; **Ca** with (3-) 4 (-8) **Se**. – [U. Eggli]

C. sladenii Schönland (Ann. South Afr. Mus. 9: 46, 1912). **T:** RSA, Northern Cape (*Pearson* 6126 [K]). – **D:** S Namibia, RSA (Northern Cape); often among rocks, autumn-flowering.

[15] Spreading somewhat scrambling sparingly branched shrubs to 50 cm tall; **R** fibrous; **Br** grey-brown, 4 mm Ø; **L** ovate to ovate-lanceolate, 25 - 40 × 15 - 25 mm, flattened, surface glabrous, grey-green with powdery bloom, basally fused with the opposite **L** of the pair, margins reddish, upper face flat, lower face convex, tips obtuse or acute; older **L** persistent; **Inf** elongated round-topped thyrses with short peduncles to 2 cm; **Fl** sessile; **Sep** triangular-lanceolate, to 2 mm, acute; **Cl** tubular, white, lobes shortly fused at the base, oblong-elliptic, to 5 mm; **Anth** black.

C. socialis Schönland (Trans. Roy. Soc. South Afr. 17: 241, 1929). **T:** RSA, Eastern Cape (*Crampton* 18 [GRA, PRE]). – **D:** RSA (Eastern Cape); in the shade of rocks, spring-flowering.

[14] Rosulate, proliferating from the base to form dense rounded clusters to 4 cm tall (excl. **Inf**); **R** fibrous; **L** 4 - 11 × 8 - 16 mm, flattish, ovate, elliptic to obovate, 4-ranked, light to dark green, glabrous but with marginal cilia, tip acute; **Inf** terminal

rounded thyrses with 1 - 3 dichasia, to 7 cm; **Fl** sessile; **Sep** to 1.5 mm, triangular-ovate, ciliate; **Cl** white, tubular, 6 mm; **Pet** oblong-obovate, to 2.5 mm, fused shortly at the base, tips spreading; **Anth** yellow.

C. solieri (Gay) F. Meigen (BJS 17: 239, 1893). **T:** Chile (Gay 178 [P]). – **D:** W USA (Wyoming, Nevada, Texas, Oregon, California), C Chile; terrestrial or subaquatic in seasonal pools. **I:** Bywater & Wickens (1984: 711, fig. 3: F-K).

≡ *Tillaea solieri* Gay (1847); **incl.** *Tillaea andicola* Philippi (1872) ≡ *Crassula andicola* (Philippi) F. Meigen (1893).

[1] Erect or decumbent; **Br** to 5.5 cm; **L** lanceolate, 2.4 - 3.3 mm; **Fl** 1 per node, 4-merous; **Ped** (0.6-) 1.2 - 2.5 mm; **Sep** triangular, 0.6 - 0.9 × 0.5 - 0.8 mm; **Pet** triangular, 0.9 - 1.3 × 0.5 - 0.6 mm, longer than the **Sep**; **NSc** filiform-spatulate, 0.65 mm; **Se** 9 - 14 per **Ca**, oblong-ellipsoid, 0.32 - 0.42 (-0.55) × 0.15 - 0.19 (-0.21) mm, reddish-brown, smooth and shiny or with obscure longitudinal ridges.

Distinctively differing from *C. aquatica* and *C. saginoides* by the smooth testa, which is the result of a persistent complete wax cover. – [U. Eggli]

C. southii Schönland (JLSB 31: 530, 1897). **T:** RSA, Eastern Cape (South 841 [GRA, PRE]). – **D:** RSA.

C. southii ssp. **southii** – **D:** RSA (Eastern Cape); grassy regions, flowers in mid-summer.

Incl. *Crassula mucronata* Keissler (1900).

[14] Erect annuals or biennials with fastigate **Br** to 25 cm tall; **L** 4 - 15 × 3 - 4 mm, alternate, flattened, triangular, subulate, glabrous, grey-green, margin ciliate, apex acute, with sturdy apical **Ha**; **Inf** erect terminal round-topped thyrses with 1 to many dichasia; **Bra** L-like becoming shorter upwards; **Fl** shortly pedicellate; **Sep** to 3.5 mm, triangular, glabrous, tip with sturdy apical **Ha**; **Cl** tubular, cream to white, to 3 mm; **Pet** oblong-obovate, to 3 mm long, fused shortly at the base, tips rounded and slightly cucullate, erect; **Anth** brown.

C. southii ssp. **sphaerocephala** Tölken (JSAB 41: 120, 1975). **T:** RSA, Eastern Cape (Bolus 8906 [BOL, GRA, K]). – **D:** RSA (S KwaZulu-Natal to Eastern Cape); shallow rocky soil, flowers mid-summer to autumn.

[14] Differs from ssp. *southii*: **Br** sinuous, decumbent, to 15 cm; **L** narrowly triangular, to 2 mm wide.

C. spathulata Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 328, 330, 1778). **T:** RSA, Eastern Cape (Thunberg 7795 [UPS]). – **D:** RSA (Eastern Cape, E border of Western Cape); mainly thickets and coastal forest.

≡ *Septimia spathulata* (Thunberg) P. V. Heath

(1993); **incl.** *Crassula lucida* Lamarck (1786); **incl.** *Crassula cyclophylla* Schönland & Baker fil. (1898) ≡ *Septimia spathulata* var. *cyclophylla* (Schönland & Baker fil.) P. V. Heath (1993); **incl.** *Crassula latispathulata* Schönland & Baker fil. (1898).

[6] Procumbent, mat-forming, to ± 10 cm tall; **R** fibrous; **Br** square, to 20 cm × 1.5 mm Ø; **Int** 5 - 30 mm; **L** bright green, ovate to cordate, 7 - 12 × 6 - 12 mm, margins serrate to crenate, base cordate to cuneate, tip obtuse; petiole 1 - 3 mm; **Inf** terminal dichasia, 0.8 - 7 cm, with 1 - 3 **Fl**; **Ped** 3 mm; **Sep** 1 mm, subulate; **Cl** stellate, white tinged pink, to 12 mm Ø; **Pet** triangular-lanceolate, 5 × 1 mm; **Fil** 3 mm; **Sty** 3 mm.

C. streyi Tölken (FPA 42(4): t. 1672 + text, 1973). **T:** RSA, KwaZulu-Natal (Strey 10958 [PRE, BOL, K, NH]). – **D:** RSA (KwaZulu-Natal); subtropical thickets, flowers in mid-winter.

≡ *Septimia streyi* (Tölken) P. V. Heath (1993).

[6] Decumbent to erect and sparingly branched herbs 10 - 20 cm tall (excl. **Inf**); **R** fibrous; **Br** 5 - 10 mm Ø; **L** sessile, 4 - 6.5 × 2.5 - 4 cm, ascending-spreading, flat, elliptic, dark green, lower face dark purplish, margins entire to subcrenulate, slightly revolute, tip acute to cuspidate; **Inf** ascending rounded lax thyrses with several dichasia; peduncle to 8 cm; **Sep** linear-triangular, to 2 mm; **Cl** 4- or 5-merous, stellate, 10 mm Ø; **Pet** fused at the base, lanceolate, to 4.5 × 2 mm, yellowish-green; **Anth** yellow.

C. strigosa Linné (Pl. Rar. Afr., 10, 1760). **T:** RSA, Cape Prov. (*Anonymus* s.n. [lecto: G [Herb. Burman]]). – **D:** RSA (Western Cape, Northern Cape); Succulent Karoo and Fynbos, spring-flowering.

≡ *Sarcolipes strigosa* (Linné) P. V. Heath (1993); **incl.** *Crassula silvatica* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Crassula centauroides* Linné (1760); **incl.** *Crassula sylvatica* Lichtenstein ex Schultes (1820); **incl.** *Sarcolipes pubescens* Ecklon & Zeyher (1837) ≡ *Crassula pubescens* (Ecklon & Zeyher) Walpers (1843) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula diaphana* Drège ex Harvey (1862); **incl.** *Crassula sarcolipes* Harvey (1862).

[2] Decumbent to erect-spreading annuals to 4.5 cm tall, often mat-forming and flushed red in sunny places, most parts hairy (strigose); **R** fibrous; **L** flat, succulent, to 4 - 15 × 2 - 9 mm, subpetiolate to shortly petiolate, elliptic to obovate, margin often ciliate, tip obtuse with larger terminal **Bri**-like **Ha**; **Inf** thyrses with many dichasia; **Fl** 5-merous, 3 mm Ø; **Ped** 2 - 8 mm; **Cal** lobes lanceolate, to 2 mm with terminal translucent **Ha**; **Cl** cup-shaped, white, lobes lanceolate, to 2 mm, tips acute; **Anth** yellow.

C. subacaulis Schönland & Baker fil. (J. Bot. 36: 370, 1898). **T:** RSA, Northern Cape (Schlechter 11498 [GRA]). – **D:** Namibia, RSA.

≡ *Globulea erosula* var. *subacaulis* (Schönland & Baker fil.) P. V. Heath (1995) (*incorrect name*, Art. 11.4).

C. subacaulis ssp. *erosula* (N. E. Brown) Tölken (BT 12(4): 634, 1979). **T:** RSA, Northern Cape (Pearson 6153 [K]). – **D:** S Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, flowers in spring.

≡ *Crassula erosula* N. E. Brown (1913) ≡ *Globulea erosula* (N. E. Brown) P. V. Heath (1995); **incl.** *Crassula inamoena* N. E. Brown (1912) ≡ *Globulea erosula* var. *inamoena* (N. E. Brown) P. V. Heath (1995) (*incorrect name*, Art. 11.4); **incl.** *Crassula rauhii* H.-C. Friedrich (1967).

[20] Differs from ssp. *subacaulis*: **Br** erect, sparingly branched, to 30 cm; **Int** 3 - 30 mm.

C. subacaulis ssp. *subacaulis* – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo, flowers in spring.

[20] Perennials forming dense spreading clusters to 60 cm tall, usually much branched from the base; **R** fibrous; **Br** brittle; **L** green to reddish, oblong-elliptic, 30 - 150 × 3 - 12 mm, spreading to ascending, glabrous or hairy, upper face convex, lower face flat to canaliculate, tip acute to bluntly acute; **Inf** elongated thyrses with several dichasia; peduncle to 40 cm, shortly pubescent; **Sep** oblong-triangular, to 2.5 mm, acute, papillate or with short **Ha**, margin ciliate; **Cl** tubular, cream to yellowish, lobes shortly fused at the base, panduriform, to 3.5 mm with a linear-elliptic dorsal appendage; **Anth** yellow.

C. subaphylla (Ecklon & Zeyher) Harvey (FC 2: 362, 1862). **T:** RSA, Western Cape (Ecklon & Zeyher 1916 [S, SAM]). – **D:** Namibia, RSA.

≡ *Sphaeritis subaphylla* Ecklon & Zeyher (1837) ≡ *Globulea subaphylla* (Ecklon & Zeyher) P. V. Heath (1995).

C. subaphylla var. *subaphylla* – **D:** S Namibia, RSA (Northern Cape, Western Cape, Eastern Cape, Free State); Succulent and Nama Karoo, flowers spring to mid-summer. **Fig. X.c**

Incl. *Sphaeritis incana* Ecklon & Zeyher (1837) ≡ *Crassula incana* (Ecklon & Zeyher) Harvey (1862); **incl.** *Sphaeritis puberula* Ecklon & Zeyher (1837) ≡ *Crassula subaphylla* var. *puberula* (Ecklon & Zeyher) Harvey (1862); **incl.** *Sedum cogmansense* Kuntze (1898) ≡ *Crassula cogmansensis* (Kuntze) K. Schumann (1900); **incl.** *Crassula remota* Schönland (1904); **incl.** *Crassula loganiana* Compton (1931).

[20] Erect multistemmed dense to sparse shrublets 15 - 30 cm tall (to 60 cm when scrambling in vegetation); **R** fibrous; **Br** woody, brittle, leafy, with greyish-brown peeling bark; younger **Br** puberulous, reddish-brown, carnos; **Int** 0.5 - 1 (-3)

cm; **L** variable in shape, hairiness and colour, 5 - 23 × 4 - 8 mm, spreading to ascending-spreading, very brittle and quickly falling when touched, green, grey-green to reddish-green, triangular-lanceolate to triangular-ovate, puberulous to glabrous, upper face flat to convex, lower face convex, tip acute; **Inf** terminal thyrses to 8 cm with numerous dichasia; **Bra** triangular, 2 - 3 mm; **Sep** 1.5 - 3 mm, lanceolate, obtuse to acute, margin ciliate; **Cl** tubular, cream, lobes fused shortly in the lower part, panduriform, to 5 mm, tips with linear elliptic appendages; **Anth** brown.

C. subaphylla var. *virgata* (Harvey) Tölken (JSAB 41: 120-121, 1975). **T:** RSA, Western Cape (Zeyher 664 p.p. [S, G, K, P, SAM]). – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo, flowers spring to mid-summer.

≡ *Crassula virgata* Harvey (1862) ≡ *Globulea subaphylla* var. *virgata* (Harvey) P. V. Heath (1995).

[20] Differs from var. *subaphylla*: **L** oblong-elliptic, ascending, green to yellowish-green, glabrous, to 4 cm, sometimes almost terete, not brittle, tips obtuse.

C. subulata Linné (Syst. Nat., ed. 10, 2: 969, 1759). **T:** [lecto - icono]: Herman, Horti Acad. Lugd.-Bat. Cat., t. 552, 1687. – **D:** RSA.

≡ *Sphaeritis subulata* (Linné) P. V. Heath (1993).

C. subulata var. *fastigiata* (Schönland) Tölken (JSAB 41: 121, 1975). **T:** RSA, Cape Prov. (Muir 3380 [GRA, PRE]). – **D:** RSA (Western Cape, Eastern Cape); Strandveld and Fynbos, flowers spring to mid-summer.

≡ *Crassula fastigiata* Schönland (1929).

[11] Differs from var. *subulata*: **Br** fastigiate, > 1 mm Ø; **Int** with recurved **Ha**; **L** glabrous, 2 - 4 mm broad.

C. subulata var. *hispida* Tölken (JSAB 41: 121, 1975). **T:** RSA, Western Cape (Bulus 6704 [BOL, GRA, K, NBG]). – **D:** RSA (Western Cape); dry Fynbos, flowers mid-summer.

Incl. *Crassula hispida* Schönland & Baker fil. (1898) (*nom. illeg.*, Art. 53.1).

[11] Differs from var. *subulata*: **Br** usually < 1 mm Ø; **Int** with recurved **Ha**; lower face of **L** hairy.

C. subulata var. *subulata* – **D:** RSA (Western Cape, Eastern Cape); dry Fynbos and Strandveld, flowers spring to mid-summer.

Incl. *Crassula ramosa* Thunberg (1778); **incl.** *Crassula capitata* Lamarck (1786); **incl.** *Sphaeritis typica* Ecklon & Zeyher (1837); **incl.** *Crassula sphaeritis* Harvey (1862); **incl.** *Crassula rustii* Schönland (1909).

[11] Erect branched glabrous herbs to ± 40 cm tall; **Br** to 5 mm Ø, grey, younger **Br** 1 mm Ø,

green, with 2 opposite vertical rows of recurved **Ha** between the **L** bases; **L** ascending-spreading, 4-ranked, 5 - 8 × 2 - 1.5 mm, subulate, linear-lanceolate, flattish, biconvex, margin ciliate, tips acute; older **L** persistent; **Inf** flat-topped to rounded thyrses with several dichasia 10 × to 15 mm Ø; peduncle indistinct; **Sep** 2 mm, oblong; **Cl** white to pale yellow, tubular, to 4.5 mm; **Pet** fused shortly at the base, elliptic to panduriform, tip with dorsal appendage; **Anth** yellow.

C. susannae Rauh & H.-C. Friedrich (KuaS 13(9): 145-148, ill., 1962). **T:** RSA, Northern Cape (Rauh 3714 [PRE, HEID]). – **D:** RSA (Northern Cape: Little Namaqualand); Succulent Karoo, flats with quartz gravel, autumn-flowering. **Fig. IX.f**

[17] Dwarf, rosulate, with erect 4-ranked **L** but sunken as a whole so that only the upper **L** margins are exposed in nature, old **L** persistent; **L** 6 - 10 × 4 - 8 mm, oblong, flat, undulating, upper face flat, lower face slightly convex, epidermis smooth, upper exposed surface papillate, grey-green to brownish, tips truncate; **Inf** cymose capitula with few sessile **Fl**; peduncle to 3 cm with recurved appressed fine **Ha**; **Sep** to 2 mm, triangular, with somewhat recurved **Ha**, margin ciliate; **Cl** tubular, to 3.5 mm, white, lobes fused shortly at the base, oblong-oblan-ceolate, tips with indistinct dorsal appendage; **Anth** black.

C. swaziensis Schönland (JLSB 31: 548, 1897). **T:** Swaziland (*Saltmarshe* s.n. in *Galpin* 992 [GRA, BOL, K, PRE, SAM, Z]). – **D:** Zimbabwe, NE RSA (Northern Prov., Gauteng, Mpumalanga, KwaZulu-Natal), Swaziland; grassland and Bushveld, flowers summer to autumn. **Fig. IX.g**

≡ *Crassula argyrophylla* var. *swaziensis* (Schönland) Schönland (1929); **incl.** *Crassula argyrophylla* Diels ex Schönland & Baker fil. (1902) ≡ *Crassula globularioides* ssp. *argyrophylla* (Diels ex Schönland & Baker fil.) Tölken (1975) ≡ *Crassula swaziensis* fa. *argyrophylla* (Diels ex Schönland & Baker fil.) R. Fernandes (1978); **incl.** *Crassula argyrophylla* var. *ramosa* Schönland (1929); **incl.** *Crassula swaziensis* fa. *brevipilosa* R. Fernandes (1978); **incl.** *Crassula swaziensis* ssp. *brachycarpa* R. Fernandes (1978); **incl.** *Crassula swaziensis* var. *guruensis* R. Fernandes (1978).

[17] Decumbent low-growing herbs to 6 cm tall and 30 cm Ø; **R** fibrous; **L** 25 - 36 × 15 - 20 mm, obovate, flattened, crowded at the **Br** tips, ascending, upper face flat, lower face slightly convex, lamina hairy or glabrous, grey-green to green, margin reddish, base cuneate, tip obtuse; **Inf** erect rounded to flat-topped thyrses with numerous dichasia; peduncle to 65 mm, 3 mm Ø at the base, with 2 pairs of **Bra**, lower **Bra** 7 × 4 mm; **Fl** sessile; **Sep** triangular-ovate, to 2 mm; **Cl** tubular, 4 mm, lobes shortly fused at the base, otherwise spreading and **Fl** to 6 mm Ø, white to cream, 4 mm long; **Fil** 3 mm.

C. tabularis Dinter (RSN 19(8-10): 146, 1923). **T:** Namibia (Dinter 4684 [B]). – **D:** S Namibia, RSA (Northern Cape, Eastern Cape, Free State); Nama Karoo and grassland in rock crevices, flowers late summer to autumn.

[14] Rosulate, solitary or proliferating from the base to form small clusters, to 30 cm tall (incl. **Inf**); **R** fibrous; **L** 10 - 45 × 5 - 15 mm, lanceolate to ovate, ascending-spreading, flattish, glabrous, upper face flat, lower face somewhat keeled, margin ciliate, tip acute to acuminate; **Inf** terminal elongated thyrses with many dichasia; **Fl** sessile; **Sep** to 3 mm, triangular, margin ciliate, tip acute with a larger apical **Ha**; **Cl** white, tubular, 5 mm; **Pet** oblong-obovate, to 4.5 mm, spreading and becoming reflexed, tips acute; **Anth** yellow.

C. tecta Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 328, 331, 1778). **T:** RSA, Western Cape (Thunberg 7799 [UPS]). – **D:** RSA (Western Cape); Succulent Karoo, quartz gravel flats, flowers autumn to mid-winter.

≡ *Purgosea tecta* (Thunberg) G. Don (1834); **incl.** *Crassula decipiens* N. E. Brown (1903).

[17] Dwarf, solitary to sparingly branched, forming small tufts 5 × 6 cm with **L** in basal **Ros**; **R** fibrous; **Br** short, axis to 5 mm Ø; **L** ovate to ovate-lanceolate, 10 - 25 × 3 - 10 mm, old persistent, lamina flattish, epidermis with short stiff papillae, grey-green, upper face flat to slightly concave near the base, lower face convex, tip obtuse; **Inf** elongated globose thyrses; peduncle papillate, to 12 cm; **Cl** to 5 mm, tubular, lobes fused at the base, oblong-oblan-ceolate, white to cream, tips with indistinct dorsal appendage; **Anth** yellow.

C. tenuicaulis Schönland (Bull. Herb. Boissier 5: 864, 1897). **T:** RSA, KwaZulu-Natal (*Schlechter* 6964 [GRA, PRE, Z]). – **D:** Zimbabwe, Lesotho, RSA (KwaZulu-Natal); grassland at high altitudes, shade of rocks and stream banks, flowers mid-summer to autumn.

[4] Spreading delicate mat-forming perennials to 10 cm Ø; **Br** rooting at the nodes; **R** fibrous; **L** 3 - 10 × 1 - 4 mm, petiole to 7 mm, lamina flat, elliptic to broadly elliptic, grey-green to yellowish green, tip obtuse; **Fl** axillary, solitary; **Cal** lobes to 2.5 mm, linear-oblan-ceolate to club-shaped, obtuse; **Cl** cup-shaped, lobes to 4 mm, elliptic, white, acute, slightly recurved to erect; **Anth** yellow.

C. tenuipedicellata Schönland & Baker fil. (J. Bot. 40: 288, 1902). **T:** RSA, Cape Prov. (*Schlechter* 11247 [GRA, BM, BOL, G, K, PRE, Z]). – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo, shade of rocks, spring-flowering.

≡ *Thisantha tenuipedicellata* (Schönland & Baker fil.) P. V. Heath (1995); **incl.** *Crassula parvipetala* Schönland (1917).

[2] Erect dwarf green glabrous annuals to 10 cm

tall; **R** fibrous; **L** 6 - 15 × 3 - 6 mm, elliptic to obovate, sessile; upper 2 **L**-pairs below the **Inf** crowded and with very short **Inf**, lamina constricted towards the base, tip obtuse; **Inf** thyrses with up to 3 dichasia; **Ped** short to long, thread-like; **Fl** 5-merous; **Cal** lobes lanceolate, to 1 mm; **Cl** cup-shaped, white, lobes oblong, to 1 mm, acute; **Anth** yellow.

C. tetragona Linné (Spec. Pl. [ed. 1], 283, 1753). **T**: LINN 400.6. – **D**: RSA.

≡ *Sedum tetragonum* (Linné) Kuntze (1898) ≡ *Creusa tetragona* (Linné) P. V. Heath (1993).

C. tetragona ssp. *acutifolia* (Lamarck) Tölken (JSAB 41: 121, 1975). **T**: Africa (*Anonymus* s.n. [P-LA]). – **D**: RSA (Western Cape, Eastern Cape); mainly on dry slopes, flowers mid-summer to autumn. **I**: (CBM 1787-: 18: t. 409, 2001). **Fig. VIII.b** ('*C. macowanii*')

≡ *Crassula acutifolia* Lamarck (1783) ≡ *Creusa tetragona* ssp. *acutifolia* (Lamarck) P. V. Heath (1993); **incl.** *Crassula bibracteata* Haworth (1824); **incl.** *Crassula acutifolia* var. *radicans* Harvey (1862) ≡ *Sedum radicans* (Harvey) Kuntze (1898); **incl.** *Crassula macowanii* Scott Elliott (1891); **incl.** *Crassula acutifolia* var. *typica* Schönland (1929) (*nom. inval.*, Art. 24.3).

[9] Differs from ssp. *tetragona*: Smaller (to 5 cm excl. **Inf**), **Br** decumbent, mat-forming, freely rooting from the nodes, 1.5 - 3 mm Ø, green to yellowish-green; older **Br** with brown to dark bark; main stem to 3 mm Ø; **L** ascending-spreading, 10 - 23 × 2 - 5 mm, triangular-lanceolate, subulate but slightly flattened, tips acute, curving upwards; older **L** persistent; **Inf** flat-topped dichasia to 16.5 cm; **Fl** in lax clusters; **Cl** to 1.5 mm long, white.

C. tetragona ssp. *connivens* (Schönland) Tölken (JSAB 41: 121, 1975). **T**: RSA, Western Cape (*Purcell* s.n. [GRA]). – **D**: RSA (Northern Cape, Western Cape); mainly on dry slopes, flowers in autumn. **I**: Tölken (1985: 144, fig. 16: 1b).

≡ *Crassula connivens* Schönland (1907) ≡ *Creusa tetragona* ssp. *connivens* (Schönland) P. V. Heath (1993); **incl.** *Crassula subsessilis* W. F. Barker (1943).

[9] Differs from ssp. *tetragona*: Larger (35 - 100 cm), **Br** fastigiate, erect, basally woody, to 3 cm Ø; young **Br** green, papillate, bark of old stems becoming smooth, brown, shiny and peeling with age; **L** ascending, 18 - 27 × 1 - 2 mm, linear-elliptic, almost terete or slightly flattened, upper face convex to flat, lower face convex, tip acute to obtuse; older **L** deciduous; **Inf** erect round-topped thyrses; peduncle indistinct, to 8 cm, without **Bra**; **Cl** to 2 mm long, white.

C. tetragona ssp. *lignescens* Tölken (JSAB 41: 122, 1975). **T**: RSA, Northern Cape (*Tölken* 3881 [BOL]). – **D**: RSA (Western Cape, Eastern Cape);

mainly on dry slopes, flowers mid-summer to autumn. **I**: Tölken (1985: 144, fig. 16: 1a).

≡ *Creusa tetragona* ssp. *lignescens* (Tölken) P. V. Heath (1993); **incl.** *Crassula acutifolia* var. *harveyi* Schönland (1929).

[9] Differs from ssp. *tetragona*: Larger (25 - 70 cm tall) and with basally woody erect to decumbent **Br** to 5 mm Ø; bark smooth, brown, peeling; **L** spreading, 10 - 20 × 2 - 4 mm, linear-lanceolate to elliptic, subulate, upper face convex to flat, lower face convex, tips curving upwards, acute; **Inf** erect round-topped thyrses to 15 cm tall and 4.5 cm Ø; peduncle to 6.5 cm with 1 pair of **Bra** 5 × 1.5 mm; **Sep** 1 mm, triangular-ovate, obtuse; **Cl** to 3 mm long, white to cream.

C. tetragona ssp. *robusta* (Tölken) Tölken (JSAB 41: 122, 1975). **T**: RSA, Eastern Cape (*Tölken* 4281 [BOL]). – **D**: RSA (Eastern Cape); mainly on dry slopes, flowers mid-summer to autumn; introduced to S Australia.

≡ *Crassula robusta* Tölken (1972) ≡ *Creusa tetragona* ssp. *robusta* (Tölken) P. V. Heath (1993).

[9] Differs from ssp. *tetragona*: Much larger, to 1 m tall; **Br** 4 mm Ø, green, bark becoming brownish with age; main stem to 35 mm Ø with bark peeling in horizontal strips; **L** 25 - 40 × 5 - 6 mm, linear-lanceolate, curving upwards, upper face flat to convex, lower face convex, tips acute, older **L** deciduous; **Inf** erect rounded thyrses to 7 cm tall and 7 cm Ø with numerous dichasia; peduncle to 5.5 cm, 4-angled with 1 pair of **Bra**; lower **Bra** L-like (10 × 2 mm), upper **Bra** smaller; **Sep** 0.5 mm, triangular-lanceolate, acute to obtuse; **Cl** to 2 × 4 mm Ø, white, lobes lanceolate; **Anth** black to brown.

This subspecies equals *C. tetragona* in the sense of most older authors.

C. tetragona ssp. *rudis* (Schönland & Baker fil.) Tölken (JSAB 41: 122, 1975). **T**: RSA, Northern Cape (*Alston* s.n. [GRA]). – **D**: RSA (Northern Cape, Western Cape); mainly on dry slopes, flowers mid-summer to autumn.

≡ *Crassula rudis* Schönland & Baker fil. (1902) ≡ *Creusa tetragona* ssp. *rudis* (Schönland & Baker fil.) P. V. Heath (1993).

[9] Differs from ssp. *tetragona* and the other ssp: **R** distinctly fleshy; stems sparingly branched, glabrous, 10 - 20 cm tall; **Br** 1.5 - 2 mm Ø, green; older **Br** with brown to dark bark; main stem to 4 mm Ø; **L** spreading, 7 - 13 × 1 - 2 mm, linear-lanceolate, flattened, upper face flat, lower face convex, tips acute; older **L** persistent; **Inf** thyrses, irregularly branched with **Fl** in clusters; peduncle with 2 - 3 pairs of **Bra**; **Cl** to 2 mm long, white.

C. tetragona ssp. *tetragona* – **D**: RSA (Northern Cape, Western Cape, Eastern Cape); dry slopes and rocks in shallow soil, flowers mid-summer to autumn. **I**: Tölken (1985: 144, fig. 16: 1c).

Incl. *Crassula densifolia* Harvey (1862) $\equiv$ *Crassula acutifolia* var. *densifolia* (Harvey) Schönland (1929).

[9] Erect to decumbent sparingly to moderately branched glabrous herbs to $\pm 10 - 20$ cm tall; **Br** 1.5 - 2 mm $\varnothing$, green; older **Br** with brown to dark bark; main stem to 8 mm $\varnothing$; **L** ascending-spreading, 10 - 25 $\times$ 2 - 3 mm, subulate but slightly flattened, tips acute, reddish; older **L** persistent; **Inf** flat-topped dichasia to 10 cm with clustered **Fl**; **Cl** to 2.5 mm, tubular, basally fused for 0.5 mm, cream to white, lobes to 2 mm, elliptic to oblanceolate, subacute, somewhat recurved; **Anth** brown.

C. thunbergiana Schultes (Syst. Veg. 6: 733, 1820). **T:** RSA, Cape Prov. (*Thunberg* 7750a [UPS, GJ]). – **D:** Namibia, RSA.

C. thunbergiana ssp. *minutiflora* (Schönland & Baker fil.) Tölken (JSAB 41: 122, 1975). **T:** RSA, Northern Cape (*Schlechter* 11496 [GRA, BM, BOL]). – **D:** S Namibia, RSA (Northern Cape); Succulent Karoo, spring-flowering.

$\equiv$ *Crassula minutiflora* Schönland & Baker fil. (1898) $\equiv$ *Thisantha debilis* var. *minutiflora* (Schönland & Baker fil.) P. V. Heath (1995).

[2] Differs from ssp. *thunbergiana*: **Br** wiry; dichasia pedunculate; **Bra** ovate to lanceolate.

C. thunbergiana ssp. *thunbergiana* – **D:** RSA (Western Cape, Eastern Cape); Strandveld, spring-flowering; introduced in W Australia.

Incl. *Tillaea decumbens* Willdenow (1798) $\equiv$ *Thisantha decumbens* (Willdenow) Ecklon & Zeyher (1837) $\equiv$ *Crassula decumbens* (Willdenow) Harvey (1862) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula debilis* Thunberg (1823) $\equiv$ *Purgosea debilis* (Thunberg) G. Don (1834) $\equiv$ *Thisantha debilis* (Thunberg) P. V. Heath (1995); **incl.** *Crassula zeyheriana* Schönland (1917).

[2] Mat-forming reddish- to yellowish-green soft decumbent glabrous annuals; **R** fibrous; **Br** translucent, often reddish inside; **L** 1 - 8 $\times$ 0.3 - 1.5 mm, flat, lanceolate, sessile, upper face flat, lower face convex, surface papillate; **Inf** thyrses with numerous sessile dichasia; **Bra** indistinct; **Fl** 5-merous; **Cal** lobes lanceolate, to 1 mm; **Cl** cup-shaped, white turning brown, lobes scarcely fused, oblong-lanceolate, ± 1 mm.

C. tillaea Lester-Garland (Fl. Jersey, 87, 1903). **T:** Europe (*Anonymus* s.n. [LINN]). – **Lit:** Holmgren (1997: 41). **D:** W, S and SE Europe, N Africa (Morocco to Tunisia), Madeira, Canary Islands, Turkey; naturalized in USA (California); dryish soil on the sides of roads and ditches. **I:** Bywater & Wickens (1984: 720, fig. 5: M-R); Brullo & Siracusa (1994: 177).

Incl. *Tillaea muscosa* Linné (1753) $\equiv$ *Crassula muscosa* (Linné) Roth (1827) (*nom. illeg.*, Art. 53.1)

$\equiv$ *Crassula alata* ssp. *muscosa* (Linné) Breistroffer (1974).

[2] Erect herbs to 4 cm tall, little-branched from the base; **L** lanceolate-triangular, 1 - 2 mm, acute; **Fl** (1-) 2 per node, 3- (to 4-) merous; **Ped** 0.2 - 0.5 (-1.5) mm; **Sep** triangular, 1.2 - 1.6 $\times$ 0.4 - 0.6 mm, aristate, longer than the **Pet**; **Pet** narrowly triangular, 0.8 - 1 $\times$ 0.2 - 0.3 mm, aristate; **NSc** filiform, narrowly spatulate, 0.5 mm; **Se** 2 per **Ca**, ellipsoid, 0.32 $\times$ 0.15 mm, reddish-brown, smooth with irregular longitudinal ridges. – [U. Eggli]

C. tomentosa Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 329, 333, 1778). **T:** RSA, Northern Cape (*Thunberg* 7803 [UPS, G-DC]). – **D:** Namibia, RSA.

$\equiv$ *Purgosea tomentosa* (Thunberg) Haworth (1821) $\equiv$ *Sphaeritis tomentosa* (Thunberg) Ecklon & Zeyher (1837).

C. tomentosa var. *glabrifolia* (Harvey) G. D. Rowley (Cact. Succ. J. Gr. Brit. 40(2): 53, 1978). **T:** RSA, Northern Cape (*Wyley* s.n. [TCD]). – **D:** S Namibia, RSA (Northern Cape, Western Cape); Nama Karoo, flowers spring to mid-summer. **Fig. X.d**

$\equiv$ *Crassula glabrifolia* Harvey (1862) $\equiv$ *Crassula interrupta* var. *glabrifolia* (Harvey) Schönland (1929); **incl.** *Crassula interrupta* Drège ex Harvey (1862) $\equiv$ *Crassula tomentosa* var. *interrupta* (Drège ex Harvey) Tölken (1975); **incl.** *Crassula scalaris* Schönland & Baker fil. (1898); **incl.** *Crassula eendornensis* Dinter (1928) (*nom. inval.*, Art. 32.1c).

[14] Differs from var. *tomentosa*: Smaller, to 30 cm (incl. **Inf**); **Ros** densely branched, tight; **L** < 15 mm long, broadly obovate with truncate tips; **Inf** unbranched spike-like thyrses with pedunculate lower dichasia.

C. tomentosa var. *tomentosa* – **D:** S Namibia, RSA (Northern Cape, Western Cape); Succulent and Nama Karoo, flowers early to mid-summer.

Incl. *Crassula linguifolia* Haworth (1803) $\equiv$ *Purgosea linguifolia* (Haworth) Haworth (1821); **incl.** *Crassula conspicua* Haworth (1821) $\equiv$ *Purgosea conspicua* (Haworth) Sweet (1830); **incl.** *Sphaeritis setigera* Ecklon & Zeyher (1837) $\equiv$ *Crassula setigera* (Ecklon & Zeyher) Schönland (1911) $\equiv$ *Crassula tomentosa* var. *setigera* (Ecklon & Zeyher) Schönland (1929).

[14] Monocarpic solitary **Ros**, or proliferating from the base to form small groups, to 60 cm tall (incl. **Inf**); **R** fibrous; **L** 2 - 10 $\times$ 1 - 3.5 cm, flattened, very variable in shape, oblanceolate to oblong-elliptic, often 2-ranked and in a dense basal **Ros**, grey-green to green, tomentose and with marginal cilia, tip rounded, truncate or acute; **Inf** terminal branched spike-like thyrses to 60 cm with many dichasia, lower dichasia pedunculate; peduncle covered with **L**-like **Bra** becoming smaller upwards; **Fl** spreading in sessile decussate glomer-

ate dichasia; **Sep** to 3 mm, triangular-ovate, tomentose and with marginal cilia; **Cl** tubular, white to yellowish; **Pet** oblong-panduriform, 4.5 mm, fused in the lower parts, tips spreading becoming slightly recurved; **Anth** black.

C. tuberella Tölken (JSAB 41: 123-124, 1975). **T:** RSA, KwaZulu-Natal (*Tölken* 3117 [BOL]). – **D:** Lesotho, RSA (Eastern Cape, E Free State, W KwaZulu-Natal); moist depressions in Afro-temperate grassland, flowers mid-summer to autumn. **I:** Tölken (1985: 106, fig. 13: 2).

[1] Erect sparingly branched perennials with fastigiate **Br** to 15 cm tall from a subterranean rhizome with many globose tubers to 3 mm Ø; **L** 5 - 15 × 1 - 1.5 mm, linear and curving upwards, glabrous, green, upper face flat, lower face convex, tip subacute; **Inf** axillary (1 - 3 **Fl**) due to reduced sympodial growth; **Cal** lobes to 1 mm, narrowly triangular, subacute; **Cl** cup-shaped, white, lobes ovate to rhombic, to 2 mm, tips subacute, recurved; **Anth** purple.

C. umbella Jacquin (Collectanea 4: 172, 1791). **T:** RSA, Western Cape (*Jacquin* s.n. [W]). – **D:** RSA (Northern Cape, Western Cape); high mountains, Succulent Karoo, flowers winter to spring. **Fig. X.e**

≡ *Septas umbella* (Jacquin) Haworth (1812) ≡ *Petrogeton umbella* (Jacquin) Ecklon & Zeyher (1837); **incl.** *Crassula flabellifolia* Harvey (1862); **incl.** *Crassula loriformis* Schönland & Baker fil. (1902); **incl.** *Crassula weissii* N. E. Brown (1908).

[7] Geophytes with erect unbranched stems to 15 cm; tuber globose with fibrous adventitious **R**; **L** 1 - 9 × 2 - 15 cm, flat and those of a pair fused into a roundish umbrella-like structure, margin entire to crenate, surface glabrous; **Inf** terminal subumbellate thyrses to 10 cm; **Sep** triangular-lanceolate, to 2 mm, acute to obtuse; **Cl** stellate, to 1 cm Ø, white or pink, lobes lanceolate to ovate, to 4.5 mm; **Anth** yellow.

C. umbellata Thunberg (Prodr. Fl. Cap., 54, 1794). **T:** RSA, Cape Prov. (*Thunberg* 7804 [UPS]). – **D:** RSA (Northern Cape, Western Cape); Succulent Karoo, Fynbos, in full sun or shade, flowers in spring.

≡ *Tillaea umbellata* (Thunberg) Willdenow (1798); **incl.** *Petrogeton alpinum* Ecklon & Zeyher (1837) ≡ *Crassula alpina* (Ecklon & Zeyher) Walpers (1843) ≡ *Bulliarda alpina* (Ecklon & Zeyher) Harvey (1862); **incl.** *Crassula nana* Schönland & Baker fil. (1898) ≡ *Crassula umbellata* var. *nana* (Schönland & Baker fil.) Schönland (1916); **incl.** *Crassula tenuis* Wolley Dod (1901).

[2] Erect dwarf green to reddish annuals to 3 cm tall, usually appressed to the ground but elongating after rains; **R** fibrous; **L** 2 - 3.5 × 1.5 - 2.5 mm, spatulate, rhombic to obovate, subsessile or petiolate to 2 mm; upper **L** crowded in a **Ros** below **Inf**; **Inf**

thyrses with a single dichasium; **Ped** 3 - 10 mm; **Fl** 4-merous, sessile at first; **Cal** lobes oblong, 0.7 mm; **Cl** cup-shaped, cream, lobes ovate, to 1 mm; **Anth** yellow.

C. umbraticola N. E. Brown (BMI 1895: 145, 1895). **T:** RSA, Free State (*Cooper* 1084 [K ?, BM, TCD, W]). – **D:** RSA (KwaZulu-Natal, Free State: Drakensberg); moist places beneath rocks in grassland, flowers mid-summer to autumn.

≡ *Septas umbraticola* (N. E. Brown) P. V. Heath (1993) (*nom. inval.*, Art. 33.2).

[7] Geophytes with erect unbranched stems to 11 cm; rhizome branched with several globose tubers with fibrous adventitious **R**; **L** in 3 - 4 pairs, 2 - 3.5 × 1.5 - 2.5 cm, flattened, obovate, elliptic to rarely orbicular, lower **L** with petioles to 1 cm, upper **L** sessile, surface glabrous, yellowish-green, margin dentate, base cuneate, tip obtuse; **Inf** terminal lax thyrses; peduncle to 3 cm; **Sep** triangular, to 2 mm; **Cl** stellate, 5-merous, white to cream, lobes lanceolate, to 4 mm, tips acute, spreading to recurved; **Anth** yellow.

C. vaginata Ecklon & Zeyher (Enum. Pl. Afric. Austral., 298, 1837). **T:** RSA, Eastern Cape (*Ecklon & Zeyher* 1903 [S, SAM]). – **D:** S Africa.

≡ *Crassula abyssinica* var. *vaginata* (Ecklon & Zeyher) Engler (1895) ≡ *Sedum vaginatum* (Ecklon & Zeyher) Kuntze (1898).

C. vaginata ssp. *minuta* Tölken (BT 12(4): 634, 1979). **T:** Swaziland (*Tölken* 5696 [PRE]). – **D:** Swaziland; shallow soil among granite outcrops in grassland, flowers mid-summer to autumn. **I:** Tölken (1985: 175, fig. 17: 2).

[14] Differs from ssp. *vaginata*: **R** as swollen basal tuber; **L** to 3 mm broad; **Inf** many (to 8), decumbent.

C. vaginata ssp. *vaginata* – **D:** Tropical W and E Africa S-wards to Lesotho, RSA (Eastern Cape, KwaZulu-Natal, Free State, Mpumalanga, Northern Prov.); grassland, flowers mid-summer to autumn. **I:** Tölken (1985: 175, fig. 17: 3).

Incl. *Crassula ciliata* var. *acutifolia* E. Meyer ex Drège (1843) (*nom. inval.*, Art. 32.1c); **incl.** *Crassula mannii* Hooker fil. (1864) ≡ *Crassula abyssinica* var. *mannii* (Hooker fil.) Engler (1892); **incl.** *Crassula drakensbergensis* Schönland (1897); **incl.** *Sedum crassiflorum* Kuntze (1898) ≡ *Crassula crassiflora* (Kuntze) K. Schumann (1900); **incl.** *Sedum flavum* var. *lanceolatum* Kuntze (1898); **incl.** *Sedum flavum* var. *reflexifolium* Kuntze (1898); **incl.** *Sedum flavum* var. *subulatum* Kuntze (1898); **incl.** *Crassula schweinfurthii* De Wildeman (1900); **incl.** *Crassula vaginata* var. *hispida* Keissler (1900); **incl.** *Crassula vaginata* var. *laxa* Keissler (1900); **incl.** *Crassula vaginata* var. *parviflora* Keissler (1900); **incl.** *Crassula abyssinica* var. *an-*

golensis Schönland (1909); **incl.** *Crassula abyssinica* var. *nyikensis* Schönland (1909); **incl.** *Crassula abyssinica* var. *ovata* Schönland (1909); **incl.** *Crassula abyssinica* var. *robusta* Schönland (1909); **incl.** *Crassula spectabilis* Schönland (1913); **incl.** *Crassula abyssinica* var. *transvaalensis* Schönland (1929); **incl.** *Crassula retrorsa* Hutchinson (1933).

[14] Rosulate, usually solitary or proliferating from the base to form small groups, to 50 cm tall (**incl.** **Inf**); **R** tuberous; **L** 5 - 350 × 4 - 35 mm, spirally arranged, flattened, lanceolate to linear-lanceolate, upper face channelled, glabrous to hairy, green to yellowish-green, margins ciliate, tips acute; **Inf** erect terminal flat-topped thyrses with many dichasia; **Bra** L-like becoming shorter upwards; **Fl** pedicellate; **Sep** to 3.5 mm, narrowly to broadly triangular, margin sparingly toothed, tips with apical sturdy **Ha**; **Cl** white to yellow, tubular, to 6 mm; **Pet** oblong to oblong-oblongate, to 5 mm, fused shortly at the base, spreading to recurved, tips rounded and slightly cucullate; **Anth** yellow.

Widespread and variable; often confused with *C. alba*, with which it may form hybrids (Wickens 1987).

C. vaillantii (Willdenow) Roth (Enum. Pl. Phaen. Germ. 1: 992, 1827). **T:** France (*Anonymus* s.n. [B-W]). – **Lit:** Jalas & al. (1999: 44-45). **D:** S and W Europe, scattered in E Europe (Russia, Kazakhstan), Cyprus, Africa to RSA (Western Cape, Northern Cape); moist depressions, flowers spring to mid-summer.

≡ *Tillaea vaillantii* Willdenow (1798) ≡ *Bulliarda vaillantii* (Willdenow) De Candolle (1801) ≡ *Tillaeastrum vaillantii* (Willdenow) Britton (1903) ≡ *Hydrophila vaillantii* (Willdenow) House (1920) (*incorrect name*, Art. 11.4); **incl.** *Bulliarda vaillantii* var. *subulata* Harvey (1862); **incl.** *Bulliarda obtusa* Gandoger (1886) (*nom. inval.*, Art. 24.1); **incl.** *Bulliarda wolgensis* Gandoger (1886) (*nom. inval.*, Art. 24.1).

[1] Soft erect to decumbent annual herbs to 15 cm tall, rooting at the nodes; **R** fibrous; **L** 2 - 4 × 1 - 2 mm, linear, green to reddish, glabrous, upper face flat, lower face convex, tip acute to obtuse; **Inf** reduced terminal solitary **Fl** (rarely up to 3) appearing axillary due to sympodial growth; **Cal** lobes to 0.4 mm, broadly triangular, tips obtuse; **Cl** cup-shaped, white to reddish, lobes to 2 mm, ovate to elliptic, tips recurved, obtuse; **Anth** purple.

C. venezuelensis (Steyermark) Bywater & Wickens (KB 39(4): 710, ill. (p. 709), 1984). **T:** Venezuela (Steyermark 55906 [F, K, NY]). – **D:** Colombia, Venezuela, Ecuador, Peru, Bolivia, Chile ?; aquatic at inland lakesides, 3000 - 4500 m.

≡ *Tillaea venezuelensis* Steyermark (1957).

[1] Erect to decumbent; aquatic **Br** to 10 cm; **L** narrowly triangular-lanceolate, 4.5 - 5 mm, sub-mucronate, at an acute angle to the stem; **Fl** 1 per

node, 4-merous; **Ped** to 15 mm; **Sep** triangular-ovate, 1 × 0.8 mm; **Pet** 1.4 × 0.7 mm, longer than the **Sep**; **NSc** filiform, 0.6 mm; **Se** 6 - 8 per **Ca**, oblong, 0.43 - 0.63 × 0.2 - 0.34 mm, reddish-brown, longitudinally striate.

Distinguished from its closest allies (*C. peduncularis*, *C. viridis*, *C. saginoides*) by the large striate seeds. – [U. Eggli]

C. vestita Thunberg (Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 6: 239, 335, 1778). **T:** RSA, Northern Cape (*Thunberg* s.n. [UPS, G, G-DC, S, STB]). – **D:** RSA (Northern Cape); Nama Karoo, dry flats on Beaufort Shales, flowers spring to mid-summer.

≡ *Creusa vestita* (Thunberg) P. V. Heath (1993).

[5] Decumbent to procumbent little branched perennials; **R** fibrous; **Br** to 8 cm, densely covered with **L** forming a columnar **Bo**; **L** 5 - 6 × 3 - 4 mm, broadly obovate to rhombic obovate, upper face concave, lower face convex, surface green to grey-green with white waxy covering, apex acute to obtuse; **Inf** terminal dichasia with up to 14 sessile **Fl**; peduncle none; **Sep** oblong-triangular, to 2 mm, obtuse; **Cl** urceolate, cream, lobes to 3 mm, oblong-obovate, fused shortly at the base, tips slightly recurved; **Anth** yellow.

C. viridis (S. Watson) Bywater & Wickens (KB 39(4): 718, ill. (p. 717), 1984). **T:** Mexico, Chihuahua (*Pringle* 1366 [VT, K, MA, NY]). – **D:** USA (Idaho, Arizona), Mexico, Brazil; terrestrial on margins of pools and rivers, or aquatic in shallow water.

≡ *Tillaea viridis* S. Watson (1888) ≡ *Tillaeastrum viride* (S. Watson) Britton (1903).

[1] Decumbent herbs 5 - 7 cm tall; **L** narrowly triangular, (4-) 6 - 9 (-10) mm, acute; **Fl** 1 per node, 4-merous; **Ped** (0.4-) 0.6 - 1 (-4) mm; **Sep** broadly triangular, 0.7 - 0.8 × 0.5 - 0.7 mm; **Pet** triangular, 1.3 × 0.6 mm, acute; **NSc** filiform, 0.6 mm; **Se** 6 - 12 per **Ca**, relatively large, oblong to narrowly reniform, (0.46-) 0.5 - 0.54 × (0.18-) 0.2 (-0.23) mm, reddish-brown, longitudinally striate, papillate.

Superficially similar to *C. venezuelensis* and *C. peduncularis* but with different seeds. – [U. Eggli]

C. volkensii Engler (Pfl.-welt Ost-Afr., Teil C, 189, 1895). **T:** Tanzania, Moshi Distr. (*Volkens* 328 [B†, BM, K]). – **D:** E Africa.

C. volkensii ssp. *coleae* (Baker) Wickens & Bywater (KB 34(4): 635-636, 1980). **T:** K. – **D:** Somalia, Kenya, Tanzania; shady rocks to 2400 m.

≡ *Crassula coleae* Baker (1895); **incl.** *Crassula nakuruensis* Engler (1907); **incl.** *Crassula zimmermannii* var. *uhligii* Engler (1907); **incl.** *Crassula somalensis* Pax ex Engler (1915) (*nom. inval.*, Art. 32.1c).

[4] Differs from ssp. *volkensii*: Pubescent; **L** 0.5 -

1.7 × 0.3 - 1.2 cm, base cuneate to long-attenuate; **Pet** oblong-obovate, to 5 × 1.5 mm.

C. volkensii ssp. **volkensii** – **D:** Kenya, Tanzania; shady rocks to 3000 m.

Incl. *Crassula galunkensis* Engler (1907).

[4] Decumbent little branched glabrous annuals or perennials; **Br** 4-angled, rooting at the lower nodes; **L** 0.6 - 5 × 0.5 - 1.5 cm, subsessile, narrowly elliptic or elliptic to obovate, oblong-ovate to spatulate, base cuneate to attenuate, margin shallowly crenate, bases of opposite **L** fused forming a shallow sheath; petioles to 1 mm; **Inf** reduced few-flowered terminal cymes, sometimes reduced to a solitary axillary **Fl**; **Ped** 2 - 15 (-40) mm; **Fl** 4-merous; **Sep** oblong, to 3.5 × 0.5 mm, glabrous or pubescent; **Pet** white to pink, oblong-lanceolate, 5 - 6 × 2 mm, tip obtuse or acute, glabrous or pubescent, minutely hooded; **St** 3 - 4 mm; **Ca** oblong, to 3.5 mm, glabrous; **Sty** 1 mm; **Se** 6 - 10 per **Ca**, broadly ellipsoid, to 0.4 × 0.2 mm, tuberculate.

C. whiteheadii Harvey (FC 2: 346, 1862). **T:** RSA, Northern Cape (*Whitehead* s.n. [TCD, S]). – **D:** RSA (Northern Cape); Succulent Karoo, flowers in spring.

[10] Much branched, dwarf, to 15 cm tall; **R** fibrous; **Br** with recurved coarse **Ha**, becoming glabrous, old with flaking bark; **L** 3 - 5 × 1 - 1.5 mm, ascending-spreading, old deciduous, linear-lanceolate, flattened, minutely papillate, upper face flat to convex, lower face markedly convex, margin ciliate, tip acute; **Inf** thyrses with cymose clusters of subsessile **Fl**; **Sep** triangular-lanceolate, to 3 mm, minutely papillate and with sparse marginal cilia; **Cl** urceolate to tubular, lobes fused shortly at the base, white to cream, to 4 mm, lorate to subpanduriform, tips obtuse, with dorsal appendage; **Anth** brown.

C. zombensis Baker *fil.* (BMI 1897: 266, 1897). **T:** Malawi (*Whyte* s.n. [K]). – **D:** Moçambique, Malawi (Zomba Distr.); on rocks.

≡ *Crassula swaziensis* var. *zombensis* (Baker *fil.*) R. Fernandes (1978).

[17] Decumbent mat-forming herbs; old **L** deciduous; **R** fibrous; main **Br** woody, to 11 cm, glabrous, procumbent, to 5 mm Ø with erect subquadrangular lateral **Br** with brown scarious bark; **Int** to 3 cm; **L** 13 - 45 × 2 - 10 mm, sessile, ascending, linear, subterete to trigonous, surface with short appressed **Ha**, grey-green, upper face grooved, lower face convex, margin entire, base slightly attenuate, tip obtuse; **Inf** erect thyrses with numerous dichasia 3 × 5 cm; peduncle to 9 cm with 2 - 3 pairs of oblong **Bra**; **Ped** to 1.5 mm; **Sep** to 2.5 mm, oblong-triangular, densely white-hairy; **Cl** white, to 4.5 mm, stellate, lobes obovate, to 2.25 mm, obtuse, mucronulate, reflexed.

×CREMNADIA

U. Eggli

×**Cretnadia** C. H. Uhl (CSJA 66(5): 215, 1994).
= *Cretnophila* × *Villadia*. Uhl (1994c) lists only the combination *C. nutans* × *V. nelsonii*.

×CREMNERIA

M. Kimnach

×**Cretneria** Moran (Baileya 19: 145, 1975). – **Lit:** Uhl (1976).
= *Cretnophila* × *Echeveria*.

The following names are of unresolved application but are referred to this genus: *Echeveria mutabilis* Deleuil *ex* Morren (1874) ≡ ×*Cretneria mutabilis* (Deleuil *ex* Morren *pro sp.*) Moran (1975); *Echeveria xpruinosa* Deleuil *ex* Morren (1874) ≡ ×*Cretneria pruinosa* (Deleuil *ex* Morren *pro sp.*) G. D. Rowley (1977); *Echeveria xscaphophylla* Hort. *ex* A. Berger (1904); *Echeveria scaphylla* Deleuil *ex* Morren (1872) ≡ ×*Cretneria scaphylla* (Deleuil *ex* Morren *pro sp.*) Moran (1975).

×**C. expatriata** (Rose *pro sp.*) Moran (Baileya 19: 145, 1975).

≡ *Echeveria xexpatriata* Rose *pro sp.* (1905).

Stem to 10 cm tall, branching; **L** densely rosulate, clavate, oblong-obovate, to 4 × 0.9 cm, green, somewhat glaucous; **Inf** cymose-paniculate, to 30 cm long, stem **Bra** easily detached; **Ped** to 8 mm, deflexed; **Sep** slightly spreading; **Cl** campanulate, to 8 × 4 mm Ø near base, 4 - 8 mm Ø at the mouth.

Similar to *Echeveria pulchella* and, like it, a probable hybrid with *E. amoena* or *Cretnophila linguifolia* as one parent.

×CREMNOPETALUM

U. Eggli

×**Cretnopetalum** Kimnach & Moran (CSJA 58(2): 55, 1986).

= *Cretnophila* × *Graptopetalum*. No formally named hybrids are known.

CREMNOPHILA

R. Moran

Cretnophila Rose (North Amer. Fl. 22(1): 56, 1905). **T:** *Sedum nutans* Rose [Typification by inference, only element included.]. – **Lit:** Uhl (1976); Moran (1978a). **D:** S Mexico. **Etym:** Gr. 'kremnos', cliff, slope; and Gr. 'philos', friend; for the habitat.

Glabrous succulent perennials; **R** fibrous; stems pendent from cliffs, few-branched; **L** alternate, rosulate, turgid, 2 - 4× wider than thick, margins

rounded; **Inf** lateral, abscissing after fruiting, peduncle with scattered reduced **L**-like **Bra**; thyrses pendent, zigzag with ascending cincinni jointed to the axis; **Ped** short; **Fl** 5-merous; **Sep** erect or ascending, unequal; **Pet** nearly completely free; **St** 10. – *Cytology*: $x = 33$.

Cremnophila has 2 closely related species, one commonly placed in *Sedum* but never in *Echeveria*, the other often in *Echeveria* but never in *Sedum*. The study of the meiosis of their hybrid by Uhl (1976) shows that it seems illogical not to place them in the same genus. So, *Cremnophila* is a compromise: Its 2 species clearly belong together but do not fit easily into any other genus. However, Uhl also found other Mexican taxa genetically close while morphologically very distinct.

Hybrids are known with *Echeveria* (= *×Cremneria*) and *Villadia* (= *×Cremnadia*), as well as with *Thompsonella* (= *×Cremsonella*).

C. linguifolia (Lemaire) Moran (Baileya 19: 145, 1975). **T**: [neo – icono]: Refug. Bot., t. 58, 1869. – **D**: Mexico (México: Malinalco, Mexicapa); ± 1900 m. **Fig. X.g**

≡ *Echeveria linguifolia* Lemaire (1863) ≡ *Cotyledon linguifolia* (Lemaire) Baker (1869); **incl.** *Anacampseros linguifolia* hort. ex Lemaire (1863) (*nom. inval.*, Art. 34.1c); **incl.** *Talinum linguiforme* Hort. ex Lemaire (1863) (*nom. inval.*, Art. 34.1c); **incl.** *Pachyphytum lingua* hort. ex Morren (1874) (*nom. inval.*, Art. 34.1c).

Stem to 1 m and more, 1 - 2.5 cm Ø; **Ros** 6 - 17 cm Ø with 15 - 25 **L**; **L** cuneate-obovate to oblong, rounded to obtuse, 4 - 9 × 1.5 - 5.5 cm; **Inf** 15 - 55 cm; **Sep** 4 - 12 × 1.5 - 5 mm; **Pet** erect, white or greenish, 6 - 11 × 2 - 4 mm, induplicate-valvate. – *Cytology*: $n = 33$.

C. nutans Rose (North Amer. Fl. 22(1): 56, 1905). **T**: Mexico, Morelos (*Pringle* 6980 [US]). – **D**: Mexico (Morelos); 1800 - 2300 m. **Fig. X.h, XI.a**

Incl. *Sedum nutans* Rose (1903) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum cremnophila* R. T. Clausen (1943).

Stem to 80 cm, 1 - 2.8 cm Ø; **Ros** 10 - 17 cm with 12 - 25 **L**; **L** rhombic-obovate to oblanceolate, rounded to broadly acute, 4 - 10 × 2 - 5.5 cm; **Inf** 10 - 25 cm; **Sep** 3 - 7 × 1 - 2.5 mm; **Pet** widely spreading, yellow, 4 - 7 × 2 - 3.5 mm, imbricate in bud. – *Cytology*: $n = 33$.

×CREMNOSEDUM

U. Eggli

×**Cremnosedum** Kimnach & G. Lyon (CSJA 53(2): 69, 1981).

= *Cremnophila* × *Sedum*. *C. nutans* × *S. humifusum* is the only formally named hybrid ('Little Gem').

×CREMSONELLA

U. Eggli

×**Cremsonella** C. H. Uhl (CSJA 66(4): 177, 1994). = *Cremnophila* × *Thompsonella*. Uhl (1994b) only lists the combination *C. nutans* × *T. minutiflora*.

×DUDLEVERIA

U. Eggli

×**Dudleveria** G. D. Rowley (Nation. Cact. Succ. J. 13(4): 75, 1958). **T**: *Echeveria spiralis* Deleuil.

Proposed for hybrids between *Dudleya* and *Echeveria*, but according to Uhl (1994a), such hybrids do not exist, despite the name *×Dudleveria spiralis* (= *Echeveria spiralis*) having been published for such a combination.

DUDLEYA

J. Thiede

Dudleya Britton & Rose (Bull. New York Bot. Gard. 3(9): 12-13, 1903). **T**: *Echeveria lanceolata* Nuttall. – **Lit**: Moran (1943a); Moran (1950); Moran (1951a); Moran (1951b); Bartel (1993); Thomson (1993); Uhl (1994a). **D**: USA (SW Oregon, S Nevada, C and W Arizona, California incl. Islands in the Pacific), Mexico (Sonora, Baja California incl. Islands); predominantly near coasts, usually rocky places, to 2200 (-3025) m. **Etym**: For Prof. William R. Dudley (1849 - 1911), US-American botanist at the Stanford University.

Incl. *Hasseanthus* Rose (1903). **T**: *Sedum variegatum* S. Watson.

Incl. *Stylophyllum* Britton & Rose (1903). **T**: *Sedum edule* Nuttall ex Torrey & A. Gray.

Perennial glabrous **L** succulent **Ros** plants; **R** mostly fibrous; stems unbranched or branched (if branched then mostly dichotomous), mostly basally ± covered with dried **L** or **L** bases, (1.5-) 10 - 40 (-90) mm Ø, usually rather short and ± erect; **Ros** terminal at the stem tips, (1-) 3- 25 (-50) cm Ø, with (3-) 20 - 40 (-120) **L**, solitary or ± branched, then normally in dense cushions; **L** variable in shape, frequently ± oblong to oblong-lanceolate to -oblanceolate, mostly upper face ± flat or slightly concave to canaliculate, lower face usually ± rounded to convex, completely united with the stem axis with a broad base, tips obtuse-rounded to acutely pointed, (0.6-) 1 - 10 (-40) × 0.2 - 3 (-10) cm, (1-) 2 - 6 (-11 -25) mm thick, usually glaucous to densely farinose, mostly evergreen; flowering **Br** axillary, strictly annual, solitary to numerous, usually ± erect to ascending, 5 - 40 (-100) cm (measurements sometimes referring only to the scape); **Inf** cymose, usually with 1 - 3 (-10) unbranched scorpioid **Br** or with 2 - 4 (to > 6) **Br** that are 1 - 2× (- 3×) dichotomously

branched, ultimate scorpioid **Br** first inrolled (always?), later $\pm$ spreading, (1-) 2 - 15 (-50) cm, with (2-) 3 - 20 (-30) **Fl**; **Bra** usually $\pm$ similar to the **L**, diminishing in size from bottom to top; **Ped** at anthesis usually $\pm$ erect to ascending, (0-) 1 - 15 (-35) mm; **Fl** 5-merous (rarely 4-merous), obdiplostemonous, mostly unscented; **Cal** (2-) 3 - 8 (-9) mm; **Sep** basally united, free lobes (1-) 1.5 - 6 (-8) mm; **Cl** 3.5 - 23 mm $\varnothing$; **Pet** usually convolute in bud, usually at least at the base $\pm$ erect-tubular, mostly $\pm$ elliptic to oblong or ovate, (5-) 7 - 14 (-20) $\times$ (1.5-) 2 - 3.5 (-5.5) mm, usually (pale) yellow or yellowish, tube (0.5-) 1 - 4 (-10) mm, lobes $\pm$ erect or $\pm$ spreading-divaricate to recurved from above the middle or apically; **St** obdiplostemonous, 10 in 2 series, inserted at the **Cl** base, shorter than the **Pet**, epipetal **St** usually somewhat shorter than the episeal **St** and often inserted slightly higher up; **Fil** tapering towards tips, base rarely > 1 mm broad; **Anth** mostly 1 - 2 mm, mostly yellow; **NSc** truncate, 2 - 3 $\times$ as broad as tall, 0.5 - 2 mm broad, shape rather constant but variable in size; gynoecium 2 - 3.5 mm $\varnothing$; **Ca** (semi-) erect at anthesis, basally mostly fused for $\pm$ 1 - 2 (-5) mm, (4-) 5 - 10 (-12) mm; **Sty** gradually or abruptly offset, slender, (0.5-) 1 - 3 (-4) mm; **Fr** consisting of 5 separate follicles, these as far as known $\pm$ completely dehiscent along the ventral suture, somewhat gaping to widely spreading, $\pm$ brown to brownish, rarely red; **Se** narrowly fusiform, testa ribbed, 0.5 - 1.5 mm $\pm$ brown. — **Cytology**: n = predominantly 17, also 34, rarely 51, 68, 85, $\pm$ 119, 136.

In order to standardize the complicated systematics of the genus, the subsequent treatments follow Bartel (1993) for the US-American taxa, and Moran (1951a) for the exclusively Mexican taxa. For the latter, numerous newer publications have been considered as well. The treatment by Thomson (1993) is in general regarded as taxonomically doubtful, and it is not further considered. The taxa there described (in part invalidly) are here at least provisionally proposed as synonyms.

Dudleya is traditionally divided into 3 subgenera, but their monophyly has not been ascertained so far. Because of the paucity of usable characters and the complex patterns of variations, no acceptable divisions have been proposed as yet for the largest of these subgenera, Subgen. *Dudleya* (see Moran (1951a) and Moran (1987)):

- [1] Subgen. *Dudleya*: Stems axis-like, above-ground, often elongate and branched; **L** perennial (rarely vernal), base 10 - 50 mm broad, lamina mostly conspicuously flattened; **Rec** $\pm$ flat; **Pet** basally erect, lobes appressed against each other (**Cl** therefore tubular) and only apically slightly spreading; **Ca** usually erect and pressed against each other. (31 species)
- [2] Subgen. *Stylophyllum* (Britton & Rose) Moran 1942: Stems axis-like, above-ground, often elongate and branched; **L** perennial, base 10 - 50

mm broad, lamina $\pm$ narrow, rarely broader (*D. formosa*), usually $\pm$ round to elliptic or somewhat flattened in cross-section; **Rec** $\pm$ conical; **Pet** basally erect, $\pm$ spreading from the middle; **Ca** ascending to broadly spreading or at least gaping. (9 species)

- [3] Subgen. *Hasseanthus* (Rose) Moran 1953: Stems usually short and thick, $\pm$ tuberous, subterranean, mostly unbranched; **L** vernal, base narrow, < 10 mm broad; **Rec** $\pm$ conical; **Pet** broadly spreading; **Fr** broadly spreading ($\pm$ erect in *D. nesiotica*). Distribution: Only S and S-C California and NW Baja California. (4 species)

A molecular study with nuclear DNA sequence data for the genus (D. H. Burton, San Diego State University, pers. comm.) implies that none of the 3 subgenera is monophyletic, that some members of Subgen. *Hasseanthus* are basal and sister to the rest of the genus, and that Subgen. *Dudleya* and Subgen. *Stylophyllum* appear to be scattered throughout the phylogeny (with tubular perianths and flattened leaves having evolved repeatedly within the genus).

Following Berger (1930), *Dudleya* was always placed in subfamily *Echeverioideae*, together with *Echeveria* and related genera. According to recent molecular research, *Dudleya* is not closely related to the genera of the *Echeveria* group (placed in the *Acre* clade of the *Crassulaceae*), however, but ends up clearly separate from these within the *Leucosedum* clade, closest to either *Sedum* Subgen. *Gormania* (cf. 't Hart (1995), Ham & 't Hart (1998), and Burton (pers. comm.)) or *Sedella* (Mort & al. 2001: as *Parvisedum*). Both groups share the distribution within the Californian winter rainfall region with *Dudleya*. The placement of *Dudleya* apart from *Echeveria* concurs with the deviating aestivation and the broad leaf bases with numerous leaf traces, the absence of hybrids (Uhl 1994a), the different testa morphology (Knapp 1994), and the geographical differentiation relative to the *Echeveria* group (Thiede 1995).

Chromosome numbers in *Dudleya* are rather diverse (Uhl & Moran 1953), and many polyploids as well as natural hybrids are present, including intersubgeneric hybrids (e.g. Moran (1951b)). Whereas most natural hybrids occur as few individuals only, at least 5 species are assumed to have originally arisen as allopolyploid intersubgeneric hybrids (*D. anomala*, *D. campanulata*, *D. gnoma*, *D. nesiotica*, *D. traskiae*) (Moran 1978b).

The pollination and breeding systems of *Dudleya* have been studied by Levin & Mulroy (1985). Most species have yellow flowers with low nectar production, are outbreeding and pollinated by bees and long-tongued flies, whereas few species with long-tubed reddish flowers and abundant nectar production are highly autofertile and hummingbird-pollinated.

Dudleya has the greatest concentration of species in the Californian winter-rainfall regions close to the coast with apparent fog influence, at altitudes from sea-level to the higher mountains. Rather few species are to be found to the N or S of this region or further inland (Thiede 1995). Accordingly and following experiences gained in cultivation in C Europe, *Dudleya* should be watered predominantly in winter and kept rather dry during the summer – as growth is more or less arrested in summer, root rot is otherwise easily induced. Propagation from leaf cuttings (a common method in the family) is not possible in *Dudleya*, since the leaves cannot be detached from the stems without damage.

D. abramsii Rose (Bull. New York Bot. Gard. 3(9): 14, 1903). **T:** USA, California (*Abrams* 3707 [US, DS, GH, NY, POM, UC, US]). – **D:** USA, Mexico.

≡ *Cotyledon abramsii* (Rose) Fedde (1904) ≡ *Echeveria abramsii* (Rose) A. Berger (1930).

D. abramsii ssp. **abramsii** – **D:** USA (SW California: San Luis Obispo County), Mexico (N Baja California); on rocks, 50 - 2600 m, flowers April to June. **I:** Desert Pl. Life 24: 15, 1952; Thomson (1993: pl. 2:1-4).

Incl. *Dudleya tenuis* Rose (1903) ≡ *Cotyledon tenuis* (Rose) Fedde (1904) ≡ *Echeveria tenuis* (Rose) A. Berger (1930) (*nom. illeg.*, Art. 53.1).

[1] Stems usually < 5 × 1 - 1.5 cm; **Ros** 2 - 8 (-15) cm Ø with 8 - 25 **L**, solitary or in groups of 5 - 20 (-75); **L** erect or ascending, oblong to oblong-lanceolate, acute or acutish, delicately pointed, 1 - 10 × 0.3 - 1.5 cm, glaucous; **Inf** scape 2 - 15 cm; **Inf** with 2 - 3 scorpioid **Br**, these solitary or 1 - 2× branched, 3 - 15 cm, with 2 - 10 (-20) **Fl**; **Ped** erect, 0.5 - 5 (-11) mm; **Cal** 3 - 5 mm, lobes triangular-ovate to lanceolate, acute, 2 - 5 × 1.5 - 3 mm; **Pet** erect, elliptic to narrowly lanceolate, margins occasionally erose, 8 - 13 × 2 - 3 mm, pale yellow, often striate with red, esp. the keel, tube 2 - 4.5 mm, lobes acute, spreading at 90°; **NSc** pale yellow; **Ca** erect, slender, drawn out, 4 - 7 mm; **Sty** 0.5 - 1.5 mm. – *Cytology*: n = 17.

According to Nakai (1988a) *D. abramsii* s.l. is distinguished from *D. cymosa* s.l. by the shorter pedicels, the longer flower tube and a larger difference in the insertion of the epipetal and episepal filaments. See also comment for *D. virens* ssp. *virens*.

D. abramsii ssp. **affinis** K. M. Nakai (Madroño 34(4): 349, fig. 4 (p. 343), 1988). **T:** USA, California (*Nakai* 1146 [CAS, LA, NY]). – **D:** USA (California: San Bernardino Mts.); rocks, granite or quartz, 1800 - 2600 m, not frequent, flowers May to July. **I:** Bartel (1993: 529).

≡ *Dudleya affinis* (K. M. Nakai) P. H. Thomson (1993); **incl.** *Dudleya baldwinensis* P. H. Thomson (1993).

[1] Differs from ssp. *abramsii*: **Ros** 3 - 6 cm Ø,

with 10 - 25 **L**, solitary, rarely branched and cushion-forming; **L** oblanceolate to elliptic, acute to acutish, 2 - 4 × 0.7 - 1.5 cm, glaucous; **Inf** scape erect, 5 - 11 cm, pale yellow to glaucous; **Inf** with 2 - 3 usually simple **Br**, scorpioid **Br** ascending, 2 - 8 cm, with 3 - 8 **Fl**; lowermost **Ped** 2.5 - 8 mm; **Pet** pale yellow, keel always striate with red, tube 1.5 - 2.5 mm, lobes spreading at 90°. – *Cytology*: n = 17.

D. baldwinensis appears to belong here, esp. as Nakai cites material from the range of this species (Baldwin Lake) in the protologue of ssp. *affinis*.

D. abramsii ssp. **bettinae** (Hoover) Bartel (Phytologia 70(4): 229, 1991). **T:** USA, California (*Hoover* 7278 [CAS, NY]). – **D:** USA (California: San Luis Obispo County); rocks in serpentine grassland, 50 - 180 m, rare. **I:** Thomson (1993: pl. 9: 3,6).

≡ *Dudleya bettinae* Hoover (1965).

[1] Differs from ssp. *abramsii*: Stems 0.3 - 2 cm Ø; **Ros** in groups of 10 - 40, richly branched and cushion-forming; **L** ± cylindrical, apically pointed, 2 - 7 × 0.2 - 0.7 cm, ± glaucous; **Inf** scape 5 - 25 cm; **Pet** apically often tinged violet, with few violet spots, tube 1 - 2 mm.

The leaves of ssp. *bettinae*, ssp. *murina* and ssp. *parva* contain a violet dye, which becomes visible when they are crushed.

D. abramsii ssp. **murina** (Eastwood) Moran (Madroño 14(3): 106, 1957). **T:** USA, California (*Eastwood* 15128a [CAS]). – **D:** USA (California: San Luis Obispo County); serpentine rocks, 120 - 300 m, not frequent. **I:** CSJA 4: 263, 1932; Thomson (1993: pl. 29: 5).

≡ *Dudleya murina* Eastwood (1930).

[1] Differs from ssp. *abramsii*: Stems 10 - 30 mm Ø; **Ros** in groups of > 10, few- to much-branched; **L** oblong to lanceolate, 3 - 11 × 0.7 - 2 cm, ± glaucous; **Inf** scape 5 - 25 cm; **Cl** 4 - 6 mm; **Pet** 9 - 14 × 3 - 3.5 mm, entirely violet-spotted, keel violet, tube 1.5 - 3 mm; **Sty** 1.5 - 2 mm. – *Cytology*: n = 17.

D. abramsii ssp. **parva** (Rose & Davidson) Bartel (Phytologia 70(4): 229, 1991). **T:** USA, California (*Bullard* s.n. in *Davidson* 3535 [US, GH, NY, UC]). – **D:** USA (California: W Santa Monica Mts.); loamy grassland, 60 - 450 m, rare, flowers May to June. **I:** Moran (1948); Thomson (1993: pl. 32: 5).

≡ *Dudleya parva* Rose & Davidson (1923).

[1] Differs from ssp. *abramsii*: **R** thickened to ± 3 mm over 2 - 4 cm and irregularly torulose; stems to 3 - 5 cm × 2 - 7 mm, ± violet; **Ros** 1 - 3 cm Ø, with 5 - 10 **L**, often several times branched; **L** linear to oblanceolate, acute, usually 1.5 - 4 × 0.3 - 0.6 cm (basally 0.5 - 1.1 cm), slightly glaucous, esp. near the base becoming ± violet, vernal, drying up in the summer from tip to base and from the outside to the inside of the **Ros**; **Inf** scape erect, 5 - 12 (-18) cm; **Inf** usually with 1 - 2 simple ascending scorpioid

Br, these 3 - 4 (-8) cm, with 5 - 8 (-12) **Fl**; **Ped** erect, 1 - 3 mm; **Pet** elliptic-oblong, 8 - 12 × 2 - 3.5 mm, pale yellow, keel often striate with red, tube 1 - 2 mm, lobes acute, with slightly recurved tips; **NSc** whitish; **Ca** 4 - 10 mm; **Sty** gradually narrowed, 2 - 3 mm. – *Cytology*: *n* = 17.

Differing from almost all other taxa of Subgen. *Dudleya* (except *D. cymosa* ssp. *marcescens*) by being completely leafless in the dry season (Moran 1948).

D. acuminata Rose (Bull. New York Bot. Gard. 3(9): 26, 1903). **T**: Mexico, Baja California (*Orcutt* 126 [US]). – **D**: Mexico (C Baja California as well as Cedros Island); mostly in coastal lowlands, to 600 m, flowers April to May. **I**: Addisonia 2: t. 48, 1917, as *D. brandegeei*; Thomson (1993: pl. 3: 2).

≡ *Cotyledon acuminata* (Rose) Fedde (1904) ≡ *Echeveria acuminata* (Rose) A. Berger (1930); **incl.** *Dudleya brandegeei* Rose (1903) ≡ *Cotyledon brandegeei* (Rose) Fedde (1904) ≡ *Echeveria brandegeei* (Rose) A. Berger (1930).

[1] Stems to (rarely) 7 × 1 - 2.5 cm Ø; **Ros** 3 - 10 cm Ø, with 10 - 20 (-25) **L**, dense, solitary or few (2 - 6) together; **L** ovate to triangular-lanceolate, broadest at the base, acute to long-attenuate, 2 - 10 × 1.5 - 3 cm, pale green or slightly glaucous; **Inf** scape erect to divaricate or decumbent, 5 - 40 cm, lower ½ without **Bra**, reddish; **Inf** glaucous, with 2 - 3 unbranched or 1 × branched scorpioid **Br**, these 1 - 12 cm, with 5 - 13 **Fl**; **Ped** erect, 2 - 10 mm; **Cal** deeply divided, 4.5 - 6 mm, lobes triangular-ovate, acute, 3 - 5 mm, green; **Pet** almost erect or connivent, oblanceolate, 10 - 14 × 2 - 2.5 mm, yellow, sometimes lineate with red, dried reddish, tube 4 - 7 mm, lobes acutely pointed; **Anth** red, orange, yellow; **NSc** whitish; **Ca** erect, appressed, 5.5 - 9 mm; **Sty** 1 - 2 mm. – *Cytology*: *n* = 17.

D. brandegeei is here synonymized with a question mark.

D. albiflora Rose (Bull. New York Bot. Gard. 3(9): 13, 1903). **T**: Mexico, Baja California Sur (*Brandegee* s.n. in *Rose* 518 [US, NY]). – **D**: Mexico (C and S Baja California as well as Cedros, Natividad and Espiritu Santo Islands); flowers April to June. **I**: Addisonia 12: t. 400, 1927; Thomson (1993: pl. 3: 3-4, 13: 3).

≡ *Cotyledon albiflora* (Rose) Fedde (1904) (*nom. illeg.*, Art. 53.1) ≡ *Echeveria albiflora* (Rose) A. Berger (1930); **incl.** *Dudleya moranii* D. A. Johansen (1932).

[1] Stems to 30 × 1 - 2 cm; **Ros** 2 - 6 cm Ø, with 10 - 25 (-35) **L**, open, normally branched and cushion-forming, cushions with up to > 200 **Ros** and to 70 cm Ø; **L** spreading, attenuate from the base or somewhat widened in the middle, slender-pointed to long-attenuate, tip terete, 2 - 6.25 × 0.5 - 1.5 cm (basally 0.5 - 2 cm), bright green or glaucous, sometimes with red tinge; flowering **Br** slender, 4 - 45

cm, red; **Inf** with 2 - 3 simple or 1 × branched scorpioid **Br**, these 3 - 8 (-20) cm, with 3 - 10 (-25) **Fl**; **Bra** spreading, intensely red; **Ped** 2 - 6 mm; **Cal** 5 - 8 mm, lobes triangular, acute, 3 - 6.5 mm; **Pet** oblong to oblanceolate, 11 - 15 × 1.5 - 3 mm, pure white, tube 3 - 4.5 mm, lobes acute, somewhat curved; **NSc** white; **Ca** 7 - 11 mm; **Sty** 1.5 - 3 mm. – *Cytology*: *n* = 34, 51, 68, ± 85.

See also *D. ingens*. *D. moranii* is here synonymized with a question mark.

D. anomala (Davidson) Moran (Desert Pl. Life 14: 191, 1943). **T**: Mexico, Baja California (*Kessler* 3653 [LAM, CU, NY, POM]). – **D**: Mexico (Baja California: Coronados and Todos Santos Islands; Punta Banda); rock walls, flowers May to June. **I**: Desert Pl. Life 15: 11, 1943; Thomson (1993: pl. 2: 5-6, 6: 1).

≡ *Stylophyllum anomalum* Davidson (1928); **incl.** *Stylophyllum coronatum* Fröderström (1936); **incl.** *Stylophyllum insulare* Fröderström (1936) (*nom. illeg.*, Art. 53.1).

[2] Stems elongate, often decumbent, to 50 × 0.5 - 1 cm; **Ros** 2 - 10 cm Ø, with 20 - 30 **L**, densely cushion-forming, cushions sometimes with far > 100 **Ros** and 30 - 40 (-60) cm Ø; **L** densely arranged to somewhat distant from each other, oblanceolate, acute, upper face somewhat convex, lower face convex, 2 - 5 × 0.4 - 0.6 cm, green, slightly viscid (at least when young); **Inf** scape 5 - 25 cm; **Inf** compact, rounded, ± 3 - 4 cm Ø, with ± 3 not or 1 × branched scorpioid **Br**, these 1 - 3 cm, with 3 - 5 **Fl**; **Ped** 2 - 5 mm; **Cal** 3 - 4 mm, lobes triangular to triangular-ovate, acute, 2 - 2.5 mm; **Pet** narrowly ovate, 8 - 10 × 3.5 - 4 mm, white, keel somewhat striate with red, tube 0 - 1 mm, lobes somewhat spreading from the base, tips recurved, acute; **Anth** orange or red; **Ca** later somewhat divaricate, 5 - 7 mm; **Sty** 1.5 - 2 mm. – *Cytology*: *n* = 51.

Apart from *D. viscida*, this is the only species with viscid leaves. Within Subgen. *Stylophyllum*, *D. anomala* is, with the exception of *D. traskiae*, the only species with more erect petals, and the corolla tube is shorter than usual (Moran 1943a).

D. anthonyi Rose (Bull. New York Bot. Gard. 3(9): 13, 1903). **T**: Mexico, Baja California (*Anthony* 123 [US, DS, F, GH, MO, NY, PH, UC]). – **D**: Mexico (Baja California: Santa Marta Island and neighbouring mainland), flowers April to July (?). **I**: Desert Pl. Life 15: 88-89, 1943; Thomson (1993: pl. 7: 1-2, 8: 1-3).

≡ *Cotyledon anthonyi* (Rose) Fedde (1904) ≡ *Echeveria anthonyi* (Rose) A. Berger (1930) ≡ *Dudleya pulverulenta* ssp. *anthonyi* (Rose) Moran (1951) (*nom. inval.*, Art. 29.1).

[1] Plants entirely densely farinose; stems erect or decumbent, to 40 - 80 × 5 - 9 cm; **Ros** 15 - 50 cm Ø, with 35 - 90 **L**; **L** oblong, usually broadest at the base, above narrowed into the strap-shaped lamina,

acute to long-attenuate, (7-) 8 - 12 (-25) × 3 - 7 (basally 4 - 5) cm, farinose; **Inf** scape 40 - 70 (-100) cm; **Inf** with 3 - 10 simple **Br**, first erect, later sometimes almost horizontal, scorioid **Br** 15 - 50 cm, with 12 - 25 **Fl**; **Ped** 12 - 15 (-25) mm; **Cal** 6 - 7 mm, lobes triangular-lanceolate to -linear, pointed, 4 - 5 mm; **Pet** usually 12 - 17 mm, deep red, tube ± 5 - 7 mm, lobes oblong-oblancoate, acute, divaricate, 6.5 - 10 × 3 - 3.5 mm; **Anth** red; **Ca** 8 - 10 mm. – *Cytology*: n = 17.

Very similar to *D. pulverulenta* ssp. *pulverulenta*, but geographically disjunct and morphologically distinguished by narrower and more stiff leaves narrowed from the base, calyx lobes that are narrow above but broadened at the base, and more narrow and acutely pointed petals, which are fused for less than ½ of their length (Moran 1943c). Natural hybrids with *D. cultrata* are known (Moran 1951b).

D. attenuata (S. Watson) Moran (Desert Pl. Life 14: 191, 1943). **T**: Mexico, Baja California (*Orcutt* 1364). – **D**: USA, Mexico.

≡ *Cotyledon attenuata* S. Watson (1887) ≡ *Echeveria attenuata* (S. Watson) Purpus (1899) ≡ *Stylophyllum attenuatum* (S. Watson) Britton & Rose (1903) ≡ *Cotyledon edulis* var. *attenuata* (S. Watson) Jepson (1936).

D. attenuata ssp. *attenuata* – **D**: Mexico (N Baja California); near coasts. **I**: Desert Pl. Life 15: 44, 1943; Thomson (1993: pl. 5: 4-6).

Incl. *Dudleya attenuata* ssp. *typica* Moran (1943) (*nom. inval.*, Art. 24.3).

[2] Stems usually erect, often elongate, to 15 cm × 3 - 10 mm, branched; **Ros** ± 5 - 15, mostly densely arranged, 2 - 5 (-10) cm Ø; **L** linear-oblancoate, acute, terete except the base or somewhat compressed, 2 - 10 cm × 2 - 5 mm, young farinose-glaucous; **Inf** scape 7 - 25 cm, reddish-glaucous; **Inf** usually with 1 - 3 simple scorioid **Br**, these 2 - 10 cm, with 3 - 15 **Fl** which are often > 1 cm distant from each other; **Ped** 0.5 - 3 (to > 5) mm; **Cal** 2 - 5 mm, lobes triangular-ovate to oblong-ovate, acute, usually 1 - 2.5 mm; **Pet** basally erect, elliptic, 4 - 8 × 1.5 - 3 mm, yellow, red-lineate, tube 0.5 - 2.5 mm, lobes spreading from near the middle (rarely from the base), acute; **Anth** yellow, rarely red; **Ca** rather ascending, later somewhat gibbous, 4 - 7.5 mm; **Sty** ± 2 mm. – *Cytology*: n = 17, 34.

D. attenuata ssp. *orcuttii* (Rose) Moran (Desert Pl. Life 14: 191, 1943). **T**: USA, California (*Orcutt* s.n. [US, UC?]). – **D**: USA (California: S San Diego County), Mexico (N Baja California and Coronados Islands); coastal rocks, to 50 m. **I**: Desert Pl. Life 15: 45, 1943; Thomson (1993: pl. 31: 3-4, 39: 3, 42: 1).

≡ *Stylophyllum orcuttii* Rose (1903) ≡ *Cotyledon orcuttii* (Rose) Fedde (1904) ≡ *Echeveria orcuttii* (Rose) A. Berger (1930) ≡ *Dudleya orcuttii* (Rose)

P. H. Thomson (1993) (*nom. inval.*, Art. 33.3); **incl.** *Stylophyllum parishii* Britton (1903) ≡ *Cotyledon parishii* (Britton) Fedde (1904) (*nom. illeg.*, Art. 53.1); **incl.** *Echeveria palensis* A. Berger (1930).

[2] Differs from ssp. *attenuata*: **Pet** 6 - 10 mm, white, often with rose hue, lineate with red, tube 0.5 - 3 mm; **Anth** red, more rarely yellow; **Fr** somewhat divaricate, basally somewhat broadened. – *Cytology*: n = 17, 34.

Geographically disjunct, but basically different from ssp. *attenuata* only in flower colour. The taxon forms natural hybrids with *D. variegata*, *D. formosa*, *D. brittonii* and *D. candida*, see Moran (1951b) and Moran & Uhl (1952). As the holotype of *D. xsemiteres* (Rose) Moran cannot be associated with any of the two last-named hybrids, which are very similar to each other, both are here united under this name (Moran & Uhl 1952).

D. blochmaniae (Eastwood) Moran (Leaf. West. Bot. 7(4): 110, 1953). **T**: USA, California (*Eastwood & Blochman* s.n. [CAS, GH, US]). – **D**: USA, Mexico.

≡ *Sedum blochmaniae* Eastwood (1896) ≡ *Hasseanthus blochmaniae* (Eastwood) Rose (1903) ≡ *Hasseanthus variegatus* var. *blochmaniae* (Eastwood) Jepson (1925).

D. blochmaniae ssp. *blochmaniae* – **D**: USA (California, S-C and S coast), Mexico (N Baja California); open rocky slopes, often on serpentine or clay, 5 - 450 m, flowers in May. **I**: Desert Pl. Life 16: 80, 1945; Thomson (1993: pl. 42: 4).

Incl. *Hasseanthus kessleri* Davidson (1923); **incl.** *Sedum gertrudianum* Eastwood (1931).

[3] Stems slightly globose to fusiform, 7 - 15 (-30) × 3 - 9 (-15) mm; **Ros** with (3-) 5 - 8 (-12) **L**; **L** linear-oblancoate to linear-spatulate, somewhat delicately crenate, obtuse, 1 - 4 (-7.5) cm × 2 - 6 (-8) (basally 1 - 4) mm, yellow-green, vernal; **Inf** 1 - 7, scapes 4 - 15 (-22) cm; **Inf** cymose, 2× to several times branched; **Bra** triangular-lanceolate to -ovate, lowermost **Bra** 5 - 15 (-25) × 3 - 6 (-9) mm; **Ped** mostly absent; **Fl** musk-scented; **Cal** lobes ovate to oblong-ovate, obtuse, 1.5 - 4 mm, often glaucous; **Cl** 10 - 14 mm Ø; **Pet** lanceolate, very slightly cucullate, basally erect, then widely spreading, 5 - 9 (-12) mm, white with red or violet markings, usually with rose-coloured dorsal mid-stripe, tube to 1 mm; **Anth** yellow, orange, red or red-brown; **NSc** pale greenish; **Ca** divaricate, 4 - 6 mm, pale green; **Fr** red. – *Cytology*: n = 17, 34, 51.

D. variegata is vegetatively very similar but immediately distinguished by its flowers. This taxon forms intersubgeneric natural hybrids with *D. edulis* (Moran 1950) and *D. verityi* (Nakai 1983).

D. blochmaniae ssp. *brevifolia* (Moran) Moran (Leaf. West. Bot. 7(4): 110, 1953). **T**: USA, Cali-

fornia (Moran 3206 [UC, DS, US]). – **D**: USA (California: S South Coast); sandstone terraces, to 250 m, threatened. **I**: Desert Pl. Life 16: 80, 1945; Thomson (1993: pl. 42: 4).

≡ *Hasseanthus blochmaniae* ssp. *brevifolius* Moran (1950) ≡ *Dudleya brevifolia* (Moran) Moran (1975) ≡ *Hasseanthus brevifolius* (Moran) P. H. Thomson (1993).

[3] Differs from ssp. *blochmaniae*: Stems oblong, 15 - 35 × 1 - 6 mm; **Ros** with 5 - 15 **L**; **L** spatulate, 7 - 15 × 2 - 7 mm; **Bra** triangular-ovate to somewhat orbicular, 2.5 - 10 × 2.5 - 8 (-10) mm. – *Cytology*: n = 17.

Forms intersubgeneric natural hybrids with *D. edulis* (Moran 1950).

D. blochmaniae ssp. *insularis* (Moran) Moran (Leaf. West. Bot. 7(4): 110, 1953). **T**: USA, California (Moran 3352 [UC]). – **D**: USA (California: Santa Rosa Island); coastal rocks. **I**: Bartel (1993: 529); Thomson (1993: pl. 42: 3).

≡ *Hasseanthus blochmaniae* ssp. *insularis* Moran (1950) ≡ *Hasseanthus insularis* (Moran) P. H. Thomson (1993).

[3] Differs from ssp. *blochmaniae*: Stems ± globose to oblong, 10 - 20 × 5 - 20 mm; **Ros** with 15 - 30 (-50) **L**; **L** ± oblanceolate, 10 - 35 × 2 - 7 mm; **Inf** scape 3 - 7 cm; **Bra** triangular-lanceolate to -ovate. – *Cytology*: n = 17.

D. brevipes Rose (Bull. New York Bot. Gard. 3(9): 24-25, 1903). **T**: Mexico, Baja California (*Orcutt* 125 [US]). – **D**: Mexico (C Baja California: Calmalli).

≡ *Echeveria brevipes* (Rose) A. Berger (1930).

[1] **Ros** in groups of 5 - 6; **L** lanceolate to strap-shaped, acute to shortly pointed, 8 - 10 × 1 - 1.8 cm, not glaucous, somewhat glossy; **Inf** scape ± 30 cm, only basally **Bra**-less; **Bra** ovate, acute, basally somewhat cordate, spreading or ascending; **Inf** with several divaricate **Br**; **Ped** 3 - 4 mm; **Cal** deeply 5-parted, lobes acute, glaucous; **Pet** tips acute, reddish-yellow.

This unresolved taxon is only known from the protologue and is probably referable to *D. acuminata* (Moran 1951a).

D. brittonii D. A. Johansen (CSJA 4: 311, 1933). **T**: Mexico, Baja California (*Gates* 344 [DS]). – **D**: Mexico (N Baja California and Todos Santos Islands); cliffs and hills near the coast, to 300 m. **I**: CSJA 21: 188-189, 1949; Thomson (1993: pl. 7: 4, 9: 4-5, 28: 1-2, 52: 3-4). **Fig. XI.b**

≡ *Dudleya candida* ssp. *brittonii* (D. A. Johansen) Moran (1951) (*nom. inval.*, Art. 29.1); *incl. Dudleya viridis* P. H. Thomson (1993) (*nom. inval.*, Art. 37.4).

[1] Stems short, 2 - 10 cm Ø; **Ros** 10 - 50 cm Ø, with 40 - 120 **L**, normally solitary, rarely in groups

of 2 - 10 **Ros**; **L** linear- to oblong-lanceolate, becoming much broader above the middle, delicately to long-acuminate, often with subulate reddish tips, 7 - 11 (-25) × (2.5-) 4.5 - 5.5 (-8.5) (basally 3 - 7) cm, densely white-farinose or green; **Inf** scape erect, mostly 1 only, (20-) 30 - 100 cm, reddish-violet; **Inf** obpyramidal to cylindrical, 7 - 22 cm Ø, with ± 3 - 6 (often more) densely arranged not or to 2× branched scorpioid **Br**, these 2 - 11 cm, with 5 - 20 **Fl**; **Bra** soon drying but not caducous; **Ped** erect, slender, 6 - 15 (-22) mm; **Cal** 5 mm, divided to more than ½, lobes long-lanceolate, acute, bright green; **Pet** erect, linear-lanceolate, somewhat keeled, mucronate, ± 9 mm, hyaline or sometimes whitish, keel with yellowish hue, tube 3 mm; **Anth** chestnut-brown; **Ca** erect, compressed, 6 - 9.5 mm; **Sty** 1 - 2 mm. – *Cytology*: n = 17.

A widespread and conspicuous large-growing species in coastal areas in N Baja California. It is closely related to *D. candida*, but differs by the usually solitary larger rosettes with more numerous and larger leaves. The green form of *D. brittonii* is moreover insufficiently differentiated from *D. ingens* (Moran 1951a). The species forms natural hybrids with *D. attenuata* ssp. *orcuttii* (= *D. xsemiteres* (Rose) Moran) and *D. formosa* (Moran & Uhl 1952). *D. viridis* appears to represent a superfluous redescription of the green-leaved form of the species.

D. caespitosa (Haworth) Britton & Rose (Bull. New York Bot. Gard. 3(9): 27, 1903). **T**: USA, California (*Menzies* s.n. [not preserved?]). – **D**: USA (California: C and S coast, N Channel Islands); coasts to 100 m, flowers May to July. **I**: Thomson (1993: pl. 11: 1-4, 29: 4).

≡ *Cotyledon caespitosa* Haworth (1803) ≡ *Echeveria caespitosa* (Haworth) De Candolle (1828); *incl. Cotyledon linguiformis* R. Brown (1811); *incl. Sedum cotyledon* J. Jacquin (1811) ≡ *Dudleya cotyledon* (J. Jacquin) Britton & Rose (1903) ≡ *Echeveria cotyledon* (J. Jacquin) Nelson & Macbride (1913); *incl. Cotyledon reflexa* Willdenow (1814) ≡ *Echeveria reflexa* (Willdenow) A. Berger (1930); *incl. Echeveria laxa* Lindley (1849) ≡ *Cotyledon laxa* (Lindley) Brewer & S. Watson (1876) ≡ *Dudleya laxa* (Lindley) Britton & Rose (1903); *incl. Cotyledon californica* Baker (1869); *incl. Echeveria californica* hort. ex Baker (1869) (*nom. inval.*, Art. 32.1); *incl. Cotyledon lingula* S. Watson (1879) ≡ *Dudleya lingula* (S. Watson) Britton & Rose (1903) ≡ *Echeveria lingula* (S. Watson) Nelson & Macbride (1913); *incl. Dudleya helleri* Rose (1903) ≡ *Cotyledon helleri* (Rose) Fedde (1904) ≡ *Echeveria helleri* (Rose) A. Berger (1930).

[1] Stems short or > 30 × (0.2-) 1.5 - 4 cm; **Ros** 5 - 20 (-30) cm Ø, with 15 - 30 (-50) **L**, in small lax or cushion-shaped groups, these sometimes to 60 cm Ø and with > 150 **Ros**; **L** usually oblong to oblong-oblanceolate, occasionally somewhat terete,

acute to slightly acuminate, 5 - 20 × (0.5-) 1 - 2 (-5) (basally 1 - 4) cm, green or glaucous; **Inf** scape 1 - 4 (-6.5) cm; **Inf** usually obpyramidal, with 3 - 5 not or up to 2× branched scorpioid **Br**, these 3 - 15 cm, with 3 - 15 **Fl**; **Ped** 1 - 6 (-11) mm; **Cal** 4 - 6 mm, lobes triangular-ovate, acute, 2 - 5 mm; **Pet** elliptic, 8 - 16 × 2.5 - 5 mm, bright yellow, rarely red or orange, tube 1.5 - 2.5 mm, lobes erect, sometimes spreading at 45°, acute; **Ca** 5.5 - 10 mm; **Sty** 1.5 - 2 mm. – *Cytology*: $n = 17, \pm 34, 51, 68, \pm 85, \pm 119$.

A variable ill-delimited and difficult complex with intermediates towards *D. cymosa*, *D. farinosa*, *D. lanceolata* and *D. palmeri* (Bartel 1993). When *D. palmeri* and *D. verityi* are segregated from *D. caespitosa*, the remaining difference to the variable *D. greenii* is esp. the bright yellow flower colour (pale yellow in *D. greenii*) according to McCabe (1997), but the existence of plants of *D. greenii* with rather bright yellow petals further blurs the distinction.

D. calcicola Bartel & Shevock (Madroño 30(4): 210-216, ill., 1983). **T**: USA, California (*Shevock* 8802 [CAS, FSC, NY, RSA, SBBG, SD, UC]). – **D**: USA (California: esp. Sequoia National Forest); open rocks, mostly limestone, 500 - 2600 m, not frequent.

≡ *Dudleya abramsii* ssp. *calcicola* (Bartel & Shevock) K. M. Nakai (1988).

[1] Stems 1 - 2 cm Ø; **Ros** 1 - 9 cm Ø, with 10 - 20 (-30) **L**, solitary or usually many, up to > 50 and forming dense cushions; **L** oblong-lanceolate or attenuate from the base to the tip, acute to acuminate, 1 - 8 (-10) × 0.3 - 1.3 (-1.6) cm, farinose to glaucous, becoming glaucous with age; **Inf** scape 3 - 18 (-25) cm, glaucous; **Inf** with 2 - 4 not or up to 3× branched spreading scorpioid **Br**, these 1 - 6 cm, with 2 - 8 (-10) **Fl**; **Ped** 1 - 14 mm; **Cal** 3 - 7 × 3 - 7 mm, lobes triangular-ovate to -lanceolate, 2.5 - 6 × 2 - 4 mm, glaucous or becoming glaucous; **Cl** 9 - 15 (-18) × 3.5 - 5 (-6) mm; **Pet** lanceolate, erect, 2 - 4 (-4.5) mm wide, straw-coloured or usually pale yellow, keel darker yellow to red-striped, tube 1 - 3 mm, lobes (esp. later) strongly recurved, narrowly pointed; **NSc** white to yellowish; **Ca** erect, slender, pressed together, 3 - 5 (-7) mm; **Sty** ± 1 - 2 mm. – *Cytology*: $n = 17$.

Intermediate between *D. abramsii* ssp. *abramsii* and *D. cymosa* ssp. *cymosa* according to the protologue. According to Nakai (1988a), it is, however, more closely related to *D. abramsii*, and the two show a broad overlap in characters, and esp. the red-striped petals and the difference in length (1 - 1.5 mm) between the episepal and epipetal filaments are congruent with the latter (*D. cymosa* < 0.5 mm).

D. campanulata Moran (CSJA 50(1): 20-22, ill., 1978). **T**: Mexico, Baja California (*Moran* 24223 [SD, NY]). – **D**: Mexico (Baja California); W-

facing coastal cliffs. **I**: Thomson (1993: pl. 10.3, 12.3, 13.4).

[2] Stems to 30 × 0.7 - 1.8 cm, covered with remains of dead **L**, richly branched and forming mound-like clumps to 60 cm Ø with up to 150 **Ros**; **Ros** 3 - 8 cm Ø with 12 - 30 **L**; **L** closely set, erect or upcurved, oblong-lanceolate, acute or at first subacuminate, apiculate, semiterete, 2 - 4 (-6) × 0.6 - 1.3 cm, first farinose, later glaucous and dull green or somewhat purplish esp. on the upper face; **Inf** 8 - 25 cm tall overall, reddish, glaucous, scape with 10 - 25 ascending **Br**; **Inf** obpyramidal, 4 - 12 cm Ø with 2 - 5 simple or bifurcate ascending **Br** with 2 - 11 **Fl**, to 7 cm; **Ped** 2 - 5 (-8) mm; **Sep** 3 - 4 mm, lobes deltoid, acute, 1.5 - 2 mm; **Cl** 10 - 16 mm Ø; **Pet** elliptic, acute, 8 - 10 × 3 - 4 (-5) mm, white or mostly tinged with pink along the keels, tube ± 2 mm, lobes acute; **NSc** 1 - 1.5 mm wide, light orange to white; **Ca** erect, 5 - 7 mm, narrowed basally, separate to below the middle; **Sty** ± 2 mm. – *Cytology*: $n = 68$.

Based on its octoploidy and the campanulate flowers, a hybrid origin between Subgen. *Stylophyllum* (possibly *D. attenuata*) and possibly Subgen. *Hasseanthus* (probably *D. virens* ssp. *hassei*) or also a member of Subgen. *Dudleya* is suggested in the protologue. The placement in Subgen. *Stylophyllum* is merely for convenience.

D. candelabrum Rose (Bull. New York Bot. Gard. 3(9): 17, 1903). **T**: USA, California (*Greene* s.n. [CAS, NY, US [photo]]). – **D**: USA (California: Santa Cruz and Santa Rosa Islands); rocks, N slopes, to 380 m, rare. **I**: Bartel (1993: 529); Thomson (1993: pl. 12: 4, 13: 1-2, 21: 5).

≡ *Cotyledon candelabrum* (Rose) Fedde (1904) ≡ *Echeveria candelabrum* (Rose) A. Berger (1930).

[1] Stems 2 - 8 cm Ø; **Ros** 10 - 50 cm Ø, with 20 - 45 **L**, solitary; **L** obovate, oblong-oblancheolate, long-attenuate, 5.5 - 17 × 3 - 7 (basally 2 - 4.5) cm, not glaucous, rarely slightly or distinctly glaucous; **Inf** scape 15 - 35 cm; **Inf** usually with 3 1 - 2× branched scorpioid **Br**, these 2.5 - 13 cm, spreading, with 5 - 25 **Fl**; **Ped** 2 - 6 mm; **Cal** lobes triangular-ovate, acute, 5 - 8 mm; **Pet** oblong, 8 - 12 × 2.5 - 3.5 mm, pale yellow, tube 1.5 - 3.5 mm, lobes acute. – *Cytology*: $n = 17$.

D. candida Britton (Bull. New York Bot. Gard. 3(9): 18, 1903). **T**: Mexico, Baja California (*Thurber* 582 [US, NY]). – **D**: Mexico (Baja California: Coronados Islands). **I**: Desert Pl. Life 14: 124, 1942; Thomson (1993: pl. 6: 2, 7: 5-6, 12: 1-2, 13: 6).

≡ *Cotyledon candida* (Britton) Fedde (1904) ≡ *Echeveria candida* (Britton) A. Berger (1930); **incl.** *Dudleya bryceae* Britton (1903) ≡ *Cotyledon bryceae* (Britton) Fedde (1904) ≡ *Echeveria bryceae* (Britton) A. Berger (1930).

[1] Stems ± 6 × 2 - 6 cm; **Ros** 7 - 21 cm Ø, with

30 - 70 **L**, normally branched and forming semiglobose cushions, these often 60 - 80 cm Ø and with several 100 **Ros**; **L** triangular-oblong to oblong or oblanceolate, basally widened, tip sharply attenuate, 5 - 11 × 1 - 3 (basally 1.5 - 4) cm, glaucous, sometimes green, often red-tipped, basal **L** mostly densely white-farinose; **Inf** scape 20 - 45 cm; **Inf** obpyramidal, dense, 4 - 18 cm Ø, with 3 - 5 (often more) not or to 2× branched scorpioid **Br**, these 2 - 11 cm, with 5 - 20 **Fl**; **Ped** 5 - 12 mm; **Cal** 5 - 8 mm, lobes linear-lanceolate, acute to long-attenuate, 3 - 6 mm; **Pet** strictly erect, oblong-lanceolate, 8.5 - 13 × 2 - 3.5 mm, pale yellow, tube 1.5 - 4 mm, lobes acute; **Anth** red or orange; **Ca** erect, pressed together, 6 - 9.5 mm; **Sty** 1 - 2 mm. – *Cytology*: n = 17.

Distinguished from the similar *D. brittonii* esp. by the smaller leaves and rosettes (see there for further comment).

D. cultrata Rose (Bull. New York Bot. Gard. 3(9): 16, 1903). **T**: Mexico, Baja California (*Orcutt* s.n. in *Rose* 379 [US]). – **D**: Mexico (Baja California: San Quintín and San Martín Island). **I**: Thomson (1993: pl. 10: 4, 15: 4-6).

≡ *Echeveria cultrata* (Rose) A. Berger (1930).

[1] Stems to 20 × 2 - 4 cm; **Ros** 3 - 8 cm Ø, with 20 - 30 **L**, branched and forming cushions with up to 10 **Ros**; **L** oblong, margins parallel, or tapering towards the tips, acute, 5 - 13 × 1 - 1.5 (basally 1.5 - 3) cm, green, not glaucous; **Inf** scape 20 - 40 cm; **Inf** with ± 3 ascending not or 1× branched scorpioid **Br**, these 6 - 25 cm, with 6 - 20 **Fl**; **Ped** erect, 5 - 12 mm; **Cal** 4.5 - 6 mm, lobes triangular, acute, 3.5 - 5 mm; **Pet** elliptic, 10 - 13 × ± 3 mm, pale yellow, tube 3 - 5 mm, lobes acute; **Anth** orange; **NSc** white; **Ca** erect, 6 - 8 mm; **Sty** ± 1 mm. – *Cytology*: n = 34.

Little-known and very similar to the inland form of *D. ingens* and probably better treated as a subspecies of that species. Natural hybrids with *D. anthonyi* are known (Moran 1951b).

D. cymosa (Lemaire) Britton & Rose (Bull. New York Bot. Gard. 3(9): 21, 1903). **T**: [neo - icono]: Refug. Bot. 1869: t. 69. – **D**: SW USA.

≡ *Echeveria cymosa* Lemaire (1858) ≡ *Cotyledon cymosa* (Lemaire) Baker (1869) ≡ *Cotyledon laxa* var. *cymosa* (Lemaire) Jepson (1925) ≡ *Echeveria laxa* var. *cymosa* (Lemaire) Jepson (1936).

See under *D. abramsii* for distinguishing characters.

D. cymosa ssp. *costafolia* Bartel & Shevock (Aliso 12(4): 701-704, ill., 1990). **T**: USA, California (Bartel 1223 [RSA, CAS]). – **D**: USA (California: Tulare County: Sequoia National Forest); limestone rocks, only known from the type locality.

≡ *Dudleya costafolia* (Bartel & Shevock) P. H. Thomson (1993).

[1] Differs from ssp. *cymosa*: Stems 1.5 - 2 cm Ø; **Ros** 1 - 5 (-7) cm Ø, with 7 - 15 (-20) **L**, richly branched, densely cushion-forming with 5 - 40 **Ros** per cushion; **L** (weakly) linear to linear-oblanceolate, (1-) 2 - 7 (-8) cm × 2.5 - 7 (-8) mm; **Inf** scape 5 - 15 (-20) cm, scorpioid **Br** 1 - 4 cm, with 2 - 7 **Fl**; **Ped** erect, 2.5 - 9 (-17) mm; **Cal** 4 - 6 mm, 2 - 5 × 2 - 4 mm, usually somewhat glaucous; **Pet** erect, lanceolate to narrowly acute, 5 - 13 (-17) × 2 - 4 mm, bright yellow, tube 1 - 3 mm, lobes spreading at the tips; **NSc** white to yellowish; **Ca** erect, tapering above, 3 - 6 mm. – *Cytology*: n = 17.

Differs from all other subspecies of *D. cymosa* by its narrow leaves in numerous small and densely arranged rosettes (cf. protologue).

D. cymosa ssp. *crebrifolia* K. M. Nakai & Verity (Madroño 34(4): 344-346, ill., 1988). **T**: USA, California (Nakai 775 [CAS, LA, MO, RSA, SD, US]). – **D**: USA (California: Los Angeles County: San Gabriel Mts.); granite slopes, 350 - 600 m, not frequent.

≡ *Dudleya crebrifolia* (K. M. Nakai & Verity) P. H. Thomson (1993).

[1] Differs from ssp. *cymosa*: Stems 1 - 2 cm Ø; **Ros** 5 - 12 cm Ø, with 6 - 15 **L**; **L** spreading to ascending, elliptic to spatulate, 4 - 10 (-15) × 2 - 5 cm, olive-green, rarely glaucous, lower face slightly chestnut-brown; **Inf** scape 10 - 30 (-50) cm, yellowish-green; **Bra** numerous (20 - 50), densely arranged; **Inf** branches 1 - 2× branched, scorpioid, 2 - 15 cm, with 2 - 15 (-20) **Fl**; **Ped** 3 - 8 mm; **Pet** elliptic, 9 - 10 × 3 - 3.5 mm, mustard-yellow, keel glaucous, tube 1 - 1.5 mm, lobes spreading at ± 45°. – *Cytology*: n = 17.

Apparently closest to ssp. *pumila*, but differing by elliptic leaves, longer inflorescence branches, more numerous and more congested bracts and a later flowering time (according to the protologue).

D. cymosa ssp. *cymosa* – **D**: USA (SW Oregon, N and C California); rocks and slopes, more rarely shady canyons, 100 - 2700 m. **I**: Bartel (1993: 529); Thomson (1993: pl. 14: 3-4). **Fig. XI.c**

Incl. *Cotyledon nevadensis* S. Watson (1876) ≡ *Dudleya nevadensis* (S. Watson) Britton & Rose (1903) ≡ *Echeveria nevadensis* (S. Watson) Nelson & Macbride (1913) ≡ *Cotyledon laxa* var. *nevadensis* (S. Watson) Jepson (1936); **incl.** *Cotyledon purpusii* K. Schumann (1896) ≡ *Echeveria purpusii* (K. Schumann) K. Schumann (1896) ≡ *Dudleya purpusii* (K. Schumann) Britton & Rose (1903); **incl.** *Cotyledon plattiana* Jepson (1901) ≡ *Dudleya plattiana* (Jepson) Britton & Rose (1903) ≡ *Echeveria plattiana* (Jepson) Nelson & Macbride (1913); **incl.** *Dudleya angustiflora* Rose (1903) ≡ *Cotyledon angustiflora* (Rose) Fedde (1904) ≡ *Echeveria angustiflora* (Rose) A. Berger (1930); **incl.** *Dudleya gigantea* Rose (1903) ≡ *Cotyledon gigantea* (Rose) Fedde (1904) ≡ *Dudleya cymosa* ssp. *gigantea*

(Rose) Moran (1957); **incl.** *Dudleya sheldonii* Rose (1903) $\equiv$ *Cotyledon sheldonii* (Rose) Fedde (1904) $\equiv$ *Echeveria sheldonii* (Rose) A. Berger (1930); **incl.** *Echeveria amadorana* A. Berger (1930); **incl.** *Echeveria lanceolata* var. *incerta* Jepson (1936).

[1] Stems short, mostly $< 5 \times 1 - 3.5$ cm; **Ros** 6 - 20 (-25) cm $\varnothing$, with 6 - 25 **L**, solitary or few together; **L** oblong-oblancheolate to rarely spatulate, acute, attenuate or rarely long-attenuate, (1.5-) $4 - 17 \times 1 - 6$ cm, 1 - 5 mm thick, glaucous; **Inf** scape (5-) 15 - 45 cm; **Inf** obpyramidal, mostly with 2 - 4 not or to $3 \times$ branched scorpioid **Br**, these 1 - 5 (-15) cm, with (1-) 2 - 10 (-20) **Fl**; **Ped** erect, lowermost 5 - 15 mm; **Cal** 3 - 7 mm, basally rounded to truncate, lobes triangular to triangular-ovate, acute to $\pm$ long-attenuate, 1.5 - $5 \times 1.5 - 4$ mm; **Pet** elliptic to narrowly lanceolate, 7 - $15 \times 2 - 4$ mm, yellow, orange or red, keel occasionally glaucous, tube 1 - 2.5 mm, lobes acute, apically spreading at $45 - 90^\circ$; **Ca** young erect, later slightly divaricate, 4 - 10 mm; **Sty** 1 - 2 mm. – *Cytology*: $n = 17$.

D. cymosa ssp. *marcescens* Moran (Madroño 14 (3): 106-108, 1957). **T**: USA, California (Moran 3078 [UC, DS, NY, POM]). – **D**: USA (California: Santa Monica Mts.); shady rocks, 150 - 500 m, rare. **I**: Desert Pl. Life 8: 70, 1936; Thomson (1993: pl. 28: 3).

$\equiv$ *Dudleya marcescens* (Moran) P. H. Thomson (1993).

[1] Differs from ssp. *cymosa*: Stems 2 - 7 (-10) mm $\varnothing$; **Ros** 3 - 6 cm $\varnothing$, with 8 - 12 (-15) **L**; **L** oblancheolate, oblong to elliptic, acute to bluntish, 1.5 - 3 (-4) $\times 0.5 - 1.2$ cm, green, vernal, drying from tip to base and within the **Ros** from outside to inside in summer; **Inf** scape 4 - 10 cm; **Inf** with 1 - 2 simple scorpioid **Br**, these 1 - 3 cm, with 2 - 5 **Fl**; **Ped** 5 - 12 mm; **Cal** lobes 2.5 - 4 mm; **Pet** 10 - $14 \times 2.5 - 3.5$ mm, bright yellow, rarely patterned with orange or red, tube ± 1.5 mm. – *Cytology*: $n = 17$.

This is the most deviating subspecies of *D. cymosa*. It is somewhat closer to ssp. *ovatifolia* and differs by the thinner stems and the narrower and esp. vernal leaves. In Subgen. *Dudleya*, vernal leaves are otherwise only found in *D. abramsii* ssp. *parva* (according to the protologue).

D. cymosa ssp. *ovatifolia* (Britton) Moran (Madroño 14(3): 108, 1957). **T**: USA, California (Hall 3255 [NY, UC, US]). – **D**: USA (California: Santa Monica Mts.); shady rocks, 150 - 500 m, rare. **I**: Nakai (1988a: 343, as ssp. *agourensis*); Thomson (1993: pl. 31: 2, 32: 1).

$\equiv$ *Dudleya ovatifolia* Britton (1903) $\equiv$ *Cotyledon ovatifolia* (Britton) Fedde (1904) $\equiv$ *Echeveria ovatifolia* (Britton) A. Berger (1930); **incl.** *Dudleya cymosa* ssp. *agourensis* K. M. Nakai (1988) $\equiv$ *Dudleya agourensis* (K. M. Nakai) P. H. Thomson (1993).

[1] Differs from ssp. *cymosa*: Stems 1 - 1.5 cm

$\varnothing$; **Ros** 5 - 10 cm $\varnothing$, usually with 6 - 10 **L**, solitary or cushion-forming with up to ± 6 **Ros**; **L** oblong to elliptic to ovate, 2 - 5 (-10) $\times$ (1-) 1.5 - 2.5 cm, green, not glaucous, dorsally often tinged with chestnut-brown; **Inf** scape (4-) 10 - 20 cm, glaucous, often tinged with red; **Inf** with 2 - 3 not or $1 \times$ branched scorpioid **Br**, these 1 - 3 cm, with 3 - 5 **Fl**; **Ped** 6 - 12 mm; **Pet** bright yellow, rarely orange- or red-patterned, sometimes glaucous along the keel, lobes apically spreading at $45 - 90^\circ$. – *Cytology*: $n = 17$.

D. cymosa ssp. *paniculata* (Jepson) K. M. Nakai (Madroño 34(4): 338, 1988). **T**: USA, California (Jepson 13419 [JEPS, LA [photo]]). – **D**: USA (California: Region of the San Francisco Bay, Inner South Coast Ranges); rocks, slopes, 30 - 1200 m.

$\equiv$ *Cotyledon caespitosa* var. *paniculata* Jepson (1901) $\equiv$ *Dudleya paniculata* (Jepson) Britton & Rose (1903) $\equiv$ *Cotyledon paniculata* (Jepson) Fedde (1904) (*nom. illeg.*, Art. 53.1) $\equiv$ *Cotyledon laxa* var. *paniculata* (Jepson) Jepson (1925) $\equiv$ *Echeveria laxa* var. *paniculata* (Jepson) Jepson (1936); **incl.** *Dudleya humilis* Rose (1903) $\equiv$ *Cotyledon humilis* (Rose) Fedde (1904); **incl.** *Echeveria jepsonii* Nelson & Macbride (1913); **incl.** *Echeveria diabolii* A. Berger (1930).

[1] Differs from ssp. *cymosa*: Stems 1 - 2 cm $\varnothing$; **Ros** mostly few; **L** oblong-oblancheolate, 3 - 10 $\times 0.5 - 2$ cm, glaucous; **Inf** scape 5 - 20 cm; **Inf** with 2 - 3 scorpioid **Br**, these 1 - $2 \times$ branched, 1 - 5 cm, with 4 - 10 **Fl**; **Ped** (3-) 6 - 12 mm; **Pet** 1.5 - 2.5 mm wide, pale yellow.

D. cymosa ssp. *pumila* (Rose) K. M. Nakai (Madroño 34(4): 336-337, 1988). **T**: USA, California (Hall 1350 [US, UC]). – **D**: USA (California: Outer South Coast Ranges, Transverse Ranges); rocky cliffs, slopes, 50 - 2600 m. **I**: Thomson (1993: pl. 53: 5).

$\equiv$ *Dudleya pumila* Rose (1903) $\equiv$ *Cotyledon pumila* (Rose) Fedde (1904) (*nom. illeg.*, Art. 53.1); **incl.** *Dudleya bernardiana* Britton (1903) $\equiv$ *Cotyledon bernardiana* (Britton) Fedde (1904) $\equiv$ *Echeveria bernardiana* (Britton) A. Berger (1930); **incl.** *Dudleya goldmanii* Rose (1903) $\equiv$ *Echeveria goldmanii* (Rose) A. Berger (1930) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon roseana* Fedde (1904); **incl.** *Echeveria parva* A. Berger (1930).

[1] Differs from ssp. *cymosa*: Stems 1 - 2 (-3) cm $\varnothing$; **Ros** 4.5 - 6.5 cm $\varnothing$, usually with 10 - 25 **L**; **L** 1.5 - 5.5 (-10) $\times 1 - 3$ (-6) cm; **Inf** scape 5 - 15 (-25) cm; **Inf** compact, scorpioid **Br** 1 - 3 cm, with 3 - 6 **Fl**; **Ped** 9 - 11 mm; **Pet** bright yellow to red, 2.5 - 4 mm wide. – *Cytology*: $n = 17$.

The type of *D. cymosa* ssp. *minor* belongs to *D. lanceolata*, and the plants so far erroneously identified as *D. cymosa* ssp. *minor* are now named as ssp. *pumila*, as they fit the type of *D. pumila* well (Nakai 1988a).

D. densiflora (Rose) Moran (Desert Pl. Life 15: 123, 1943). **T:** USA, California (Abrams 2652 [DS, GH, MO, NY, PH, POM]). – **D:** USA (California: Los Angeles County, San Gabriel Mts.); steep granite canyon walls, 300 - 520 m, rare, flowers in June. **I:** Desert Pl. Life 15: 57, 60, 1943; Bartel (1993: 529); Thomson (1993: pl. 14: 2).

≡ *Stylophyllum densiflorum* Rose (1903) ≡ *Cotyledon densiflora* (Rose) Fedde (1904) ≡ *Echeveria densiflora* (Rose) A. Berger (1930); **incl.** *Cotyledon nudicaule* Abrams (1903) (*nom. illeg.*, Art. 53.1); **incl.** *Echeveria nudicaulis* Munz (1935) ≡ *Dudleya nudicaulis* (Munz) Moran (1943) ≡ *Stylophyllum nudicaulis* (Munz) Abrams (1944).

[2] Stems < 20 × 1 - 2.5 cm, branched and cushion-forming; **Ros** 7 - 25 cm Ø, with 20 - 40 **L**; **L** linear, ± cylindrical except the base, apically abruptly pointed, 6 - 15 cm × 6 - 12 (basally 1 - 2) mm, glaucous, farinose; **Inf** scape 10 - 30 cm, with few **Bra**, lower ½ sometimes without **Bra**; **Inf** 4 - 10 cm Ø, with 3 to several 1 - 2× branched scorpioid **Br**, these 2 - 4 cm, with 2 - 8 **Fl**; **Ped** 2 - 5 mm; **Cal** lobes triangular-ovate, 1.5 - 2.5 mm; **Pet** narrowly ovate, 5 - 10 × 2 - 3 mm, white or rose-coloured, tube 0.5 - 2 mm, lobes divaricate from near the middle, acute; **NSc** white; **Ca** abruptly diverging, strongly gibbous, 5 - 10 mm; **Sty** 2 - 3 mm; **Fr** divaricate. – *Cytology*: n = 17.

Closely related to *D. edulis* and differing by the farinose more strongly flattened leaves, less numerous bracts, denser inflorescences, longer pedicels, shorter calyx lobes and longer styles, see Moran (1943a) and Moran (1951a).

D. edulis (Nuttall) Moran (Desert Pl. Life 14: 191, 1943). **T:** USA, California (Nuttall s.n. [BM?, NY, PH]). – **D:** USA (California: Peninsular Ranges, South Coast), Mexico (N Baja California); rocky slopes, 10 - 750 (-1300) m, flowers May to July. **I:** CSJA 64: 24, 1992; Thomson (1993: pl. 16: 1-6, 17: 1-4, 53: 3).

≡ *Sedum edule* Nuttall (1840) ≡ *Cotyledon edulis* (Nuttall) Brewer (1876) ≡ *Stylophyllum edule* (Nuttall) Britton & Rose (1903) ≡ *Echeveria edulis* (Nuttall) Purpus ex A. Berger (1930).

[2] Stems mostly erect and short, 1 - 4.5 cm Ø; **Ros** 5 - 10 (-20) cm Ø, with ± 10 - 25 **L**, branched and forming cushions up to 50 cm Ø; **L** densely arranged, linear, ± cylindrical except the base, very acute to acutish, 5 - 20 (-40) × 0.3 - 1 (basally 1.5 - 3) cm, pale green, somewhat glaucous but not farinose; **Inf** scape 20 - 50 (-70) cm; **Inf** open, elongate, with several (rarely only 2 - 3) 1 - 2× branched spreading scorpioid **Br**, these 4 - 10 cm, with 3 - 11 **Fl**; **Ped** 0 - 2 mm; **Fl** sometimes slightly scented; **Cal** 4 - 5 mm, lobes oblong-ovate, acute, usually 2.5 - 4.5 mm, the erect part often overtopping the **Cl**; **Pet** oblong-lanceolate, 7 - 10 × 2 - 3 mm, white, tube 1 - 2 mm, lobes apically broadly spreading or ± recurved, acute or mucronate; **Anth** red; **Ca** at

anthesis erect, abruptly diverging in fruit and strongly gibbous, 6 - 8 mm; **Sty** 1 - 2 mm; **Fr** divaricate, basally strongly bulging. – *Cytology*: n = 17.

A very well-distinguished species, recognizable by pale or light green (not glaucous) terete leaves, open inflorescences with usually several branches, divaricate to somewhat recurved narrow white petals, and divaricate fruits, see Moran (1951a) and Moran (1992a). Natural hybrids are known with *D. attenuata* ssp. *orcuttii*, *D. blochmaniae* ssp. *blochmaniae* and ssp. *brevifolia*, *D. formosa* and *D. stolonifera* (Moran 1951b).

D. farinosa (Lindley) Britton & Rose (Bull. New York Bot. Gard. 3(9): 15, 1903). **T:** USA, California (Hartweg s.n. [CGE, DS [photo]]). – **D:** USA (SW Oregon, California: North Coast, N and C Central Coast); near coasts, to 150 m. **I:** CSJA 26: 3-8, 1954; Bartel (1993: 533); Thomson (1993: pl. 15: 1, 19: 2). **Fig. XI.g**

≡ *Echeveria farinosa* Lindley (1849) ≡ *Cotyledon farinosa* (Lindley) Baker (1869); **incl.** *Echeveria farinulenta* Lemaire (1864); **incl.** *Dudleya compacta* Rose (1903) ≡ *Cotyledon compacta* (Rose) Fedde (1904) ≡ *Echeveria compacta* (Rose) A. Berger (1930); **incl.** *Dudleya eastwoodiae* Rose (1903) ≡ *Cotyledon eastwoodiae* (Rose) Fedde (1904) ≡ *Echeveria eastwoodiae* (Rose) A. Berger (1930); **incl.** *Dudleya septentrionalis* Rose (1903) ≡ *Cotyledon septentrionalis* (Rose) Fedde (1904) ≡ *Echeveria septentrionalis* (Rose) A. Berger (1930).

[1] Stems often elongate, 1 - 3 cm Ø; **Ros** 4 - 10 cm Ø, with 15 - 30 **L**, mostly much-branched; **L** oblong-ovate, apically acute, usually with a clear keel ± in the middle and smaller keels on either side, 2.5 - 6 × 1 - 2.5 cm, strongly farinose or green; **Inf** scape 10 - 35 cm; **Inf** usually rather dense, flat-topped, 4 - 8 cm Ø, with 3 - 5 not or 1× branched scorpioid **Br**, these 1 - 3.5 cm, with 3 - 11 **Fl**; **Ped** 1 - 3 (-5) mm; **Cal** 5 - 8 mm, lobes triangular-ovate, acute, 3 - 7 mm; **Pet** oblanceolate, mostly not touching each other laterally, 10 - 14 × 3 - 5 mm, pale yellow, tube 1 - 2 mm, lobes apically sometimes ± spreading, acute to obtuse; **Ca** 5 - 8 mm; **Sty** ± 2 mm. – *Cytology*: n = 17.

Forms natural hybrids with *D. pulverulenta* (Moran 1951a). *Echeveria cotyledon* sensu Jepson 1936 belongs here.

D. formosa Moran (Desert Pl. Life 22(6): 65-68, ill., 1950). **T:** Mexico, Baja California (Moran 2208 [UC 806722, CAS, CU, DS, NY, POM, US]). – **D:** Mexico (Baja California: locally at the Río Guadalajara); N-exposed cliffs, flowers May to June. **I:** Thomson (1993: pl. 20: 1-3).

[2] Stems pendent, > 50 × 0.5 - 2.5 cm; **Ros** 4 - 13 cm Ø, with 10 - 20 (-30) **L**, rather flat, laxly cushion-forming, sometimes several 100 **Ros** together; **L** oblong to oblong-obovate, acute to obtuse

but usually mucronate, 2 - 8 × 1 - 3 cm, bright green or red-tipped, not glaucous; **Inf** scape 4 - 15 (-19) cm, red; **Inf** dense, semiglobose or somewhat flat-topped, 2 - 6 (-9) cm Ø, usually with 3 - 7 1× (to 2×) branched scorpioid **Br**, these to 2 cm, with 2 - 6 **Fl**; **Ped** 1 - 3 mm; **Cal** 2 - 3 mm, lobes triangular, acute, 1 - 2 mm; **Pet** elliptic, white, rose-tinged, or with red keel, tube 1 - 1.5 mm, lobes divaricate from the middle, acute; **Ca** 6 - 7 mm; **Sty** slender, 2 - 2.5 mm; **Fr** widely divaricate. – *Cytology*: *n* = 17.

Differs from all other species of Subgen. *Stylophyllum* by the short broad leaves and the combination of dense inflorescences, stout pedicels, small calyx lobes, divaricate rose-coloured petals and widely spreading fruits (Moran 1951a).

D. gatesii D. A. Johansen (CSJA 4: 286, ill., 1932). **T**: Mexico, Baja California (*Gates* 325 [†?]). – **D**: Mexico (C Baja California); flowers April to May. **I**: Thomson (1993: pl. 19: 5-6).

[1] Stems to 20 × 2 - 5 cm; **Ros** 10 - 20 cm Ø, with 25 to over 40 **L**, solitary or 2 - 3 together; **L** triangular-ovate to oblong, long-attenuate, 6 - 15 × 1.5 - 3.5 (basally 2 - 5) cm, pale green, somewhat glaucous, occasionally reddish, thickly leathery when dry; **Inf** scape 20 - 70 cm, red; **Inf** rather flat, 10 - 30 cm Ø, with 3 - 4 not or to 2× branched scorpioid **Br**, these 4 - 14 cm, with 7 - 17 **Fl**; **Ped** 6 - 12 mm; **Cal** 6 - 7 mm, lobes triangular, acute, 4 - 5 mm; **Pet** narrowly oblong, 10 - 14 × ± 2 mm, white or tinged with rose, tube 5 - 6 mm, lobes acute; **Anth** red; **Ca** slender, erect, 6 - 9.5 mm; **Sty** 1 - 2 mm. – *Cytology*: *n* = 34.

Typical plants are very similar to the coastal form of *D. ingens* (Moran 1951a).

D. gnoma S. McCabe (Madroño 44(1): 49-51, ill., 1997). **T**: USA, California (*McCabe* 792 [CAS, SBBG, UC]). – **D**: USA (California: Santa Rosa Island); dry volcanic soils, 20 - 70 m. **I**: Thomson (1993: pl. 47: 5, as *D. nana*).

Incl. *Dudleya greenei* fa. *nana* Moran (1951) (*nom. inval.*, Art. 29.1); **incl.** *Dudleya nana* P. H. Thomson (1993) (*nom. inval.*, Art. 37.4).

[1] Stems 5 - 26 × (1.5-) 12 - 20 mm; **Ros** 8 - 51 mm Ø, with 8 - 19 **L**, cushion-forming and up to 57 together; **L** triangular to triangular-ovate, (6-) 9 - 25 × 5 - 13 mm, acute, intensely glaucous with solitary waxy line, esp. near apex with wine-red hue; **Inf** glaucous, with usually 2 (-5) not or to 1× branched scorpioid **Br**, these first spreading, later horizontal or reflexed, 2.5 - 12.9 cm; **Bra** discolouring dark red to violet-red when crushed; **Ped** erect, 1 - 3 mm; **Cal** lobes triangular, acute, 3.5 - 4 × 2 - 3 mm, apically wine-red or greenish-yellow, glaucous; **Pet** slightly contorted in bud, erect or erectly ascending, elliptic, 8 - 9 (-11) × 3 mm, pale to bright yellow, sometimes orange, tube 1 - 2 mm, lobes occasionally apically slightly recurved; **Ca** 4 - 6 mm; **Sty** 2 - 3 mm. – *Cytology*: *n* = 34.

A polymorphic species, which probably originated (like *D. traskiae*) as a hybrid between Subgen. *Dudleya* (*D. greenei*?) and Subgen. *Stylophyllum*. This is supported by the intermediate flower shape and the tetraploid cytology. *D. gnoma* differs from *D. greenei* by the smaller rosettes with shorter triangular to triangular-ovate leaves, smaller flowers and shorter pedicels.

D. greenei Rose (Bull. New York Bot. Gard. 3(9): 17, 1903). **T**: USA, California (*Greene* s.n. [CAS, NY [fragment], US [fragment]]). – **D**: USA (California: San Miguel, Santa Rosa and Santa Cruz Islands); coastal cliffs, to 150 m, not frequent. **I**: Thomson (1993: pl. 21: 2-3, 29: 1, 51: 2).

≡ *Cotyledon greenei* (Rose) Fedde (1904) ≡ *Echeveria greenei* (Rose) A. Berger (1930); **incl.** *Dudleya hoffmannii* D. A. Johansen (1932); **incl.** *Dudleya regalis* D. A. Johansen (1932); **incl.** *Dudleya echeverioides* D. A. Johansen (1935).

[1] Stems branched, often elongate, 7.5 - 15 × 2 - 5 cm Ø; **Ros** 10 - 15 cm Ø, with 20 - 35 **L**, 12 - 20 together; **L** oblong-ob lanceolate to obovate, apically acute to pointed, 3 - 11 × 1 - 3.5 (basally 1 - 3) cm, 4 - 8 mm thick, not glaucous to ± farinose-powdery; **Inf** scape 15 - 40 cm; **Inf** with 3 - 4 not or up to 2× branched scorpioid **Br**, these 1 - 9 cm, with 2 - 15 **Fl**; **Ped** 1 - 5 mm; **Cal** lobes triangular, 1.5 - 5 mm; **Pet** 8 - 12 × 3 - 5 mm, elliptic, pale yellow or whitish, tube 1.5 - 2.5 mm, lobes acute. – *Cytology*: *n* = 34, 51.

A variable complex hardly different from *D. caespitosa* (Bartel 1993). See further comment for *D. virens* ssp. *insularis*.

D. guadalupensis Moran (Madroño 11(4): 154-157, ill., 1951). **T**: Mexico, Baja California (*Moran* 2947 [DS 324267+324268]). – **D**: Mexico (Baja California: Guadalupe Island). **I**: Thomson (1993: pl. 21: 6, 22: 1-4, 29: 6).

[1] Stems > 10 × 1.5 - 3.5 cm Ø; **Ros** 3 - 6 cm Ø, with 35 - 75 **L**, very dense, branched and forming rounded cushions with up to > 60 **Ros**; **L** oblong-ob lanceolate, short to long attenuate, 25 - 65 × 8 - 13 (basally 4 - 8) mm, not glaucous; **Inf** scape 20 - 30 cm, curved, glaucous; **Inf** with 2 - 3 ascending not or 1× branched scorpioid **Br**, these 4 - 8 cm, with 7 - 12 **Fl**, glaucous; **Ped** 3 - 5 (-8) mm; **Cal** 6 - 8 mm, lobes narrowly triangular-ovate, acute, 3 - 5 mm; **Pet** erect, linear-lanceolate, not touching each other above the **Cal**, strongly keeled, 11 - 13 × 2 - 2.5 mm, white, keel somewhat greenish, tube 1 - 2 mm, lobes acute; **NSc** white; **Ca** 7 - 10 mm, parallel-erect or curved outwards; **Sty** 3 - 4 mm. – *Cytology*: *n* = 17.

The characteristically curved inflorescences are not found in any other species. Differs according to the protologue by its flat thin leaves within Subgen. *Stylophyllum*.

D. ingens Rose (Bull. New York Bot. Gard. 3(9): 18, 1903). **T:** Mexico, Baja California (*Brandegeae* s.n. [UC, US [fragment, photo]]). – **D:** Mexico (N Baja California); to 1000 m, flowers April to June. **I:** Thomson (1993: pl. 21: 1-4).

≡ *Echeveria ingens* (Rose) A. Berger (1930); **incl.** *Cotyledon rugens* Fedde (1904) (*nom. inval.*, Art. 61.1); **incl.** *Dudleya viridicata* D. A. Johansen (1933); **incl.** *Dudleya eximia* D. A. Johansen (1935); **incl.** *Dudleya cedrosensis* Moran (1951) (*nom. inval.*, Art. 29.1); **incl.** *Dudleya tenuifolia* P. H. Thomson (1993) (*nom. inval.*, Art. 37.4).

[1] Stems short or to $40 \times 1.5 - 6$ cm Ø; **Ros** 5 - 40 cm Ø, with 20 - 70 **L**, solitary or few together; **L** oblong, tapering from the base or somewhat broadened in the upper $\frac{1}{3}$, often thickly leathery when dry, 7 - $25 \times 1 - 5.5$ (basally 1.5 - 6) cm, green or somewhat glaucous; **Inf** scape 30 - 90 cm; **Inf** sometimes nutant even when fully grown, 5 - 20 cm Ø, usually with 3 - 4 not or up to $2 \times$ branched scorpioid **Br**, these 4 - 15 (-20) cm, often glaucous, with (6-) 10 - 20 (-30) **Fl**; **Ped** 5 - 15 (-20) mm; **Cal** 6 - 7 mm, lobes triangular, acute or slightly pointed, 4 - 6 mm; **Pet** oblong, 10 - $15 \times 2 - 3$ mm, pale yellow to white, often rose-tinged, tube 3 - 6 mm, lobes acute; **Anth** red to yellow; **NSc** white; **Ca** erect, longish, 7.5 - 11.5 mm; **Sty** 1.5 - 2 mm. – *Cytology*: $n = 17, 34$.

A variable species with gradual intermediates between the large-growing coastal form (which is very similar to the more northerly distributed *D. brittonii*) and the smaller inland-form (Moran 1951a). The type collection of *D. cedrosensis* was later identified as *D. ingens* aff. (Uhl & Moran 1953), but could probably more properly belong to *D. albiflora*, as is also indicated by Thomson (1993: 167). *D. tenuifolia* appears to belong here.

D. lanceolata (Nuttall) Britton & Rose (Bull. New York Bot. Gard. 3(9): 23-24, 1903). **T:** USA, California (Nuttall s.n. [BM, NY, PH]). – **D:** USA (California: South Coast, Transverse and Peninsular Ranges, Desert Mountains), Mexico (N Baja California); rock slopes, 30 - 1250 m, flowers April to June. **I:** Bartel (1993: 533); Thomson (1993: pl. 26: 1-6, 27: 1-4).

≡ *Echeveria lanceolata* Nuttall (1840) ≡ *Cotyledon lanceolata* (Nuttall) Brewer & S. Watson (1876) (*nom. illeg.*, Art. 53.1); **incl.** *Dudleya brauntonii* Rose (1903) ≡ *Cotyledon brauntonii* (Rose) Fedde (1904) ≡ *Echeveria brauntonii* (Rose) A. Berger (1930); **incl.** *Dudleya congesta* Britton (1903) ≡ *Cotyledon congesta* (Rose) Fedde (1904) ≡ *Echeveria congesta* (Rose) A. Berger (1930); **incl.** *Dudleya elongata* Rose (1903) ≡ *Cotyledon elongata* (Rose) Fedde (1904) ≡ *Echeveria elongata* (Rose) A. Berger (1930) ≡ *Dudleya lanceolata* ssp. *elongata* (Rose) Moran (1951) (*nom. inval.*, Art. 29.1); **incl.** *Dudleya hallii* Rose (1903) ≡ *Cotyledon hallii* (Rose) Fedde (1904) ≡ *Echeveria hallii*

(Rose) Nelson & Macbride (1913); **incl.** *Dudleya lurida* Rose (1903) ≡ *Cotyledon lurida* (Rose) Fedde (1904) (*nom. illeg.*, Art. 53.1) ≡ *Echeveria lanceolata* var. *lurida* (Rose) Munz (1935); **incl.** *Dudleya minor* Rose (1903) ≡ *Cotyledon minor* (Rose) Fedde (1904) ≡ *Echeveria minor* (Rose) A. Berger (1930) ≡ *Echeveria laxa* var. *minor* (Rose) Jepson (1936) ≡ *Dudleya nevadensis* ssp. *minor* (Rose) Abrams (1945) ≡ *Dudleya cymosa* ssp. *minor* (Rose) Moran (1957); **incl.** *Dudleya parishii* Rose (1903) ≡ *Cotyledon parishii* (Rose) Fedde (1904) ≡ *Echeveria parishii* (Rose) A. Berger (1930); **incl.** *Dudleya robusta* Britton (1903) ≡ *Cotyledon robusta* (Britton) Fedde (1904) ≡ *Echeveria robusta* (Britton) A. Berger (1930); **incl.** *Dudleya reflexa* Britton (1905) ≡ *Echeveria reflexa* (Britton) A. Berger (1930) (*nom. illeg.*, Art. 53.1); **incl.** *Echeveria monicae* A. Berger (1930); **incl.** *Dudleya bicolor* P. H. Thomson (1993); **incl.** *Dudleya temeculana* P. H. Thomson (1993); **incl.** *Dudleya pendletonia* P. H. Thomson (1993) (*nom. inval.*, Art. 37.4).

[1] Stems erect, short, rarely $10 - 12 \times 1 - 3$ cm Ø; **Ros** 2.5 - 45 cm Ø, usually with 25 - 30 **L**, solitary or with a few daughter **Ros** formed within the **Ros**; **L** oblong-lanceolate, acute to abruptly pointed, 5 - 20 (-30) $\times 1 - 3$ (-4) (basally 1 - 3) cm, glaucous or green; **Inf** scape 15 - 75 cm; **Inf** with 2 - 3 not or $1 \times$ branched scorpioid **Br**, these later ascending, 2 - 15 (-25) cm, with 2 - 20 **Fl**; lowermost **Ped** 2 - 12 mm; **Cal** 4 - 7 mm, lobes triangular-ovate, acute, 3 - 6 mm; **Pet** elliptic to oblanceolate, 10 - $16 \times 3.5 - 5$ mm, inside greenish to orange-yellow, outside yellow or mostly red or red-tinged or -patterned, tube 1 - 2 mm, lobes acute; **NSc** whitish; **Ca** erect, 5 - 11.5 mm; **Sty** 1 - 3 mm. – *Cytology*: $n = 34, 68$.

A widespread, variable and ill-defined complex (Moran 1951a). *D. bicolor*, *D. pendletonia* and *D. temeculana* appear to belong here as well.

D. linearis (Greene) Britton & Rose (Bull. New York Bot. Gard. 3(9): 16, 1903). **T:** Mexico, Baja California (*Pond* s.n. [US]). – **D:** Mexico (Baja California: Islas San Benito); flowers March to May. **I:** Thomson (1993: pl. 29: 3, 30: 3).

≡ *Cotyledon linearis* Greene (1889) ≡ *Echeveria linearis* (Greene) A. Berger (1930).

[1] Stems 1 - 2 cm Ø; **Ros** 2 - 5 cm Ø, with 20 - 40 **L**, branched and cushion-forming with 10 - 20 **Ros** together; **L** erect or somewhat spreading, oblong to oblong-oblanceolate, long-attenuate to acutely pointed, 2.5 - $6 \times 0.5 - 1$ (basally 0.5 - 0.8) cm, green, not glaucous; **Inf** scape 6 - 17 cm, lower $\frac{2}{3}$ or at least $\frac{1}{3}$ without **Bra**; **Inf** rather dense, with 2 - 3 usually simple scorpioid **Br**, these ascending, 2 - 5 cm, with 2 - 10 **Fl**; **Ped** 2 - 6 mm; **Cal** 4 - 6 mm, lobes triangular-lanceolate, acute, 2.5 - 4 mm; **Pet** erect, 7 - $12 \times \pm 2.5$ mm, yellow, tube 1.5 - 2.5 mm; **Ca** erect, compressed, 9 mm; **Sty** ± 3 mm. – *Cytology*: $n = 17$.

Vegetatively most similar to *D. guadalupensis* (Moran 1951a).

D. multicaulis (Rose) Moran (Leaf. West. Bot. 7(4): 110, 1953). **T:** USA, California (*Hasse* s.n. [US]). – **D:** USA (California: Los Angeles, Orange, Riverside, San Diego and San Bernardino Counties); coastal flats, rock and steep slopes, 10 - 600 (-1200) m, often loamy soils, rare, flowers April to June. **I:** Desert Pl. Life 16: 70-74, 1945; Bartel (1993: 533); Thomson (1993: pl. 42: 5-6). **Fig. XI.d**

≡ *Hasseanthus multicaulis* Rose (1903) ≡ *Sedum multicaule* (Rose) Fedde (1904) (*nom. illeg.*, Art. 53.1); **incl.** *Hasseanthus elongatus* Rose (1903) ≡ *Sedum elongatum* (Rose) Fedde (1904) (*nom. illeg.*, Art. 53.1) ≡ *Hasseanthus variegatus* var. *elongatus* (Rose) Johnston (1918); **incl.** *Sedum oblongirhizum* A. Berger (1930) ≡ *Hasseanthus oblongirhizus* (A. Berger) P. H. Thomson (1993) (*nom. illeg.*, Art. 52.1); **incl.** *Sedum sanctae-monicae* A. Berger (1930).

[3] Stems oblong, 13 - 50 × 3 - 18 mm; **Ros** with 6 - 15 **L**, solitary; **L** erect or spreading, linear, cylindrical except the base, apically narrowly acute, 3 - 15 cm × 1.5 - 6 (basally 3 - 10) mm, vernal; **Inf** scape 4 - 25 (-36) cm; **Inf** 1 - 35 per plant, cymose, with 2 to several scorpioid **Br**, these 2 - 10 cm, with 3 - 15 **Fl**; **Ped** 0 - 3 mm; **Cal** lobes triangular-ovate to linear-oblong, acute to obtuse, 2 - 4 mm; **Cl** 12 - 18 mm Ø; **Pet** elliptic-lanceolate, 5 - 9 × 2 - 3 mm, yellow, often spotted with red, tube 1 - 2 mm, lobes spreading or apically somewhat recurved, acute; **Anth** darker yellow; **NSc** yellow; **Ca** 5 - 8 mm, basally fused for 1 - 2 mm, yellowish-green to red; **Sty** 1.5 - 2 mm. – *Cytology*: n = 17.

Very variable as to plant size. Most closely related to *D. variegata* with very similar flowers (Moran 1950).

D. nesiotica (Moran) Moran (Leaf. West. Bot. 7(4): 110, 1953). **T:** USA, California (*Moran* 3362 [UC 860247]). – **D:** USA (California: Santa Cruz Island); coastal rocks, to 50 m, rare. **I:** CSJA 55: 199, 1983; Thomson (1993: pl. 41: 4, 42: 4).

≡ *Hasseanthus nesioticus* Moran (1950).

[3] Stems ± globose, 1 - 2 (-3) × 0.7 - 1.5 (-2) cm; **Ros** with 8 - 16 **L**; **L** oblanceolate to spatulate, acute to obtuse, 2.5 - 3.5 (-5) × 0.5 - 1.5 (-2.5) (basally 0.4 - 1.2) cm, 2 - 5 mm thick, vernal; **Inf** scape 3 - 7 (-10) cm; **Inf** usually with 2 simple scorpioid **Br** with 3 - 8 **Fl**; **Ped** 1 - 2 mm; **Fl** with musk-like scent; **Cal** 4 - 6 mm, lobes triangular-ovate, 3 - 4 mm; **Pet** elliptic, ± erect to ascending-divaricate, 7 - 14 × 3.5 - 5.5 mm, white, basally and along the keel yellowish-green, tube 1 - 2 mm, lobes acute; **Anth** yellow or orange; **Ca** erect, 5 - 8.5 mm; **Sty** 1.5 - 3 mm. – *Cytology*: n = 34.

According to Moran (1978b), Moran (1978c) and Nakai (1983), this could represent an intersubgener-

ic hybrid between Subgen. *Hasseanthus* (*D. blochmaniae*) and Subgen. *Dudleya*, and this is also indicated esp. by the broader and more erect petals as well as by the more erect carpels.

D. nubigena (Brandeggee) Britton & Rose (Bull. New York Bot. Gard. 3(9): 22, 1903). **T:** Mexico, Baja California Sur (*Brandeggee* s.n. [UC 124956]). – **D:** Mexico (S Baja California).

≡ *Cotyledon nubigena* Brandeggee (1891) ≡ *Echeveria nubigena* (Brandeggee) A. Berger (1930).

D. nubigena ssp. *cerralvensis* Moran (Trans. San Diego Soc. Nat. Hist. 15: 269-271, fig. 3, 1969). **T:** Mexico, Baja California Sur (*Moran* 3618 [SD 69717, BH, DS, UC, US]). – **D:** Mexico (S Baja California: Cerralvo Island); N-exposed granite cliffs, ± 120 m. **I:** CSJA 59: 235-242, 1987.

≡ *Dudleya nubigena* var. *cerralvensis* (Moran) hort. (s.a.) (*nom. inval.*, Art. 29.1) ≡ *Dudleya cerralvensis* (Moran) P. H. Thomson (1993).

[1] Differs from ssp. *nubigena*: **L** green or slightly glaucous, not farinose; **Inf** with 2 - 8 not or to 2× branched scorpioid **Br**, pale green; **Ped** pale green; **Cal** pale green; **Pet** pure yellow, unmarked. – *Cytology*: n = 17.

D. nubigena ssp. *nubigena* – **D:** Mexico (S Baja California: Cape region); open rocky places or cliffs, to 1800 m, flowers December to April (in cultivation from October). **I:** CSJA 59: 235-239, 1987. **Fig. XI.e**

Incl. *Dudleya xanti* Rose (1903) ≡ *Cotyledon xanti* (Rose) Fedde (1904) ≡ *Echeveria xanti* (Rose) A. Berger (1930).

[1] Stems to 7 × 1 - 1.5 (-2.5) cm; **Ros** 4 - 18 cm Ø, with 10 - 22 (-30 in cultivation) **L**, ± flat, usually solitary, rarely few together; **L** triangular-lanceolate to oblong-obovate, often long attenuate, congested, 3 - 10 (-15) × 1.5 - 3 (-3.5) cm, glaucous to usually farinose; **Inf** scape (5-) 10 - 30 (-40) cm, lowermost 2 - 12 cm without **Bra**, ± rose-coloured to red; **Inf** usually with 2 - 3 mostly simple scorpioid **Br**, ± rose-coloured to red, **Br** later erect to divaricate, 2 - 15 (-30) cm, with 4 - 24 **Fl**; **Ped** 8 - 25 (-40 in cultivation) mm, rose-coloured; **Cal** 3 - 6 mm, ± rose-coloured to red, lobes 2 - 5 × 2 - 3.5 mm; **Cl** 7 - 10 (-12) × 4 - 6 (basally) to 2.5 - 4 (apically) mm; **Pet** oblong, 1.5 - 2.5 mm wide, yellow to usually orange or coral-red, tube (2.5-) 3.5 - 4.5 (-5.5) mm, lobes obtuse to broadly pointed; **NSc** white; **Ca** 5 - 9 mm, greenish; **Sty** abruptly narrowed, 1 - 1.5 mm, yellowish or reddish. – *Cytology*: n = 17.

D. pachyphytum Moran & M. Benedict (Phytologia 47(2): 85-87, 1980). **T:** Mexico, Baja California (*Moran & Benedict* 29036 [SD, NY, SBBG]). – **D:** Mexico (Baja California: Cedros Island); 450 m. **I:** CSJA 52: 238-239, 1980; 53: 132-133, 1981.

[1] Stems erect, later decumbent, > 40 × 2 - 5 cm;

Ros 12 - 22 (-33) cm Ø, with 12 - 25 (-35, in cultivation to 55) **L**, compact, forming cushions to > 70 cm Ø with 10 - 20 (-50) **Ros**; **L** ovate to oblong, broadest at the base, rounded to broadly obtuse, delicately attenuate, 5 - 10 (-13) × 3 - 5 (-7) cm, 15 - 25 mm thick, farinose, old often pale orange; **Inf** 1 - 4, erect or usually divaricate, scape 20 - 50 (-70) cm, farinose, pale rose-coloured, esp. near the base becoming red; **Inf** 8 - 14 cm Ø, with 3 - 6 densely arranged usually 1 - 2× branched scorpioid **Br**, these spreading with age, 2 - 3 cm, with 5 - 12 **Fl**; **Ped** erect, 2 - 6 mm; **Cal** 5 - 9 mm, lobes 4 - 7 × 2.5 - 4 mm; **Cl** 8 - 11 × 4 - 5 mm; **Pet** erect, elliptic-oblong, 2 - 3 mm wide, white, tube 2 - 3 mm, lobes partly apically slightly recurved, acute; **Anth** red; **NSc** white; **Ca** 7 - 10 mm; **Sty** ± 1.2 - 2 mm. – *Cytology*: n = 17.

Impossible to confuse with any other species of *Dudleya* on account of the very thick leaves reminiscent of the crassulaceous genus *Pachyphytum*. The white flowers concur with the polyploid *D. albiflora* which also occurs on Cedros Island, but *D. albiflora* is much smaller according to the protologue and further differs by smaller and esp. narrower, pointed to narrowly-pointed leaves.

D. palmeri (S. Watson) Britton & Rose (Bull. New York Bot. Gard. 3(9): 24, 1903). **T**: USA, California (*Palmer* s.n. [GH?]). – **D**: USA (California: Central Coast, South Coast, San Luis Obispo and Santa Barbara Counties); coastal regions, to 100 m. **I**: Bartel (1993: 533); Thomson (1993: pl. 32: 6).

≡ *Cotyledon palmeri* S. Watson (1879) ≡ *Echeveria palmeri* (S. Watson) Nelson & Macbride (1913) (*nom. illeg.*, Art. 53.1).

[1] Stems few-branched, 10 - 20 × 2 - 4 cm Ø; **Ros** 5 - 20 cm Ø, with 15 - 25 **L**, laxly branching; **L** oblong-lanceolate, acute to long-attenuate, 5 - 20 × 1.5 - 5 cm, green; **Inf** scape 20 - 65 cm; **Inf** with ± 3 not or up to 2× branched scorpioid **Br**, these 5 - 8 cm, with 5 - 14 **Fl**; **Ped** 2 - 10 mm; **Cal** lobes triangular-ovate, acute, 3 - 5 mm; **Pet** elliptic, 11 - 16 × 3 - 5 mm, red or yellow with red, tube 1.5 - 2 mm, lobes erect, acute. – *Cytology*: n = 68, ± 85, 119.

Synonymized under *D. caespitosa* by Moran (1951a) but again treated as a separate species by Munz (1968) and Bartel (1993).

D. pauciflora Rose (Bull. New York Bot. Gard. 3(9): 22, 1903). **T**: Mexico, Baja California Norte (*Brandeggee* s.n. [CAS 247, US]). – **D**: Mexico (N Baja California: Sierra San Pedro Martír, Sierra Borja); cliffs and rocky slopes, 1250 - 3025 m, flowers usually July to August. **I**: Moran (1988); Thomson (1993: pl. 36: 5-6).

≡ *Cotyledon pauciflora* (Rose) Fedde (1904) ≡ *Echeveria pauciflora* (Rose) A. Berger (1930).

[1] Stems short, 7 - 25 mm Ø; **Ros** 3 - 9 cm Ø, with (10-) 15 - 25 (-30) **L**, congested and up to 10

Ros in cushions to 30 cm Ø; **L** triangular-lanceolate, apically usually regularly narrowing, narrowly acute and delicately pointed, 2 - 5 (-7.5) × 0.5 - 2 (basally) to 0.7 - 1.5 (apically) cm, apically almost terete, green to farinose; **Inf** scape 5 - 30 cm, lowermost 0.5 - 4 cm without **Bra**, red, glaucous; **Inf** 2 - 9 cm Ø, red, glaucous, usually with 2 - 3 not or 1× branched scorpioid **Br**, these 1 - 15 cm, with 2 - 16 **Fl**; lowermost **Ped** 7 - 20 (-24) mm, red; **Cal** 3 - 5 mm, red, lobes 2 - 4 × 1.5 - 2.5 mm; **Cl** pentagonal, 6 - 10 (-12.5) × 3 - 4 (-5.5) (basally) to 2 - 5 (apically) mm; **Pet** oblong, 1.5 - 3 mm wide, yellow, above and along the keel with red markings or tinge, appearing orange to red, tube 2 - 4 mm, lobes acute; **NSc** white or yellowish; **Ca** 5.5 - 7 (-9) mm, basally white to yellowish above; **Sty** gradually tapering, 1.5 - 2 mm; **Fr** reddish-brown. – *Cytology*: n = 17, 34.

A very distinct species, recognizable by the congested small rosettes with narrow leaves with a subulate tip, brightly coloured inflorescences, long slender and usually erect pedicels, and small yellow distinctly red-spotted flowers, which are at least at times visited by hummingbirds (Moran 1988).

D. pulverulenta (Nuttall) Britton & Rose (Bull. New York Bot. Gard. 3(9): 13, 1903). **T**: USA, California (*Nuttall* s.n. [BM, NY, PAS]). – **D**: USA, Mexico.

≡ *Echeveria pulverulenta* Nuttall (1840) ≡ *Cotyledon pulverulenta* (Nuttall) Baker (1869).

D. pulverulenta ssp. **arizonica** (Rose) Moran (Desert Pl. Life 15: 72, ill., 1943). **T**: USA, Arizona (*Bly* s.n. [US, NY, PAS]). – **D**: USA (California, S Nevada, W Arizona), Mexico (N Baja California, N Sonora); dry rocky slopes, 350 - 1500 m, flowers April to June. **I**: Thomson (1993: pl. 6: 3, 7: 4-6, 10: 2). **Fig. XI.h**

≡ *Dudleya arizonica* Rose (1923) ≡ *Echeveria pulverulenta* ssp. *arizonica* (Rose) Clokey (1931) ≡ *Echeveria arizonica* (Rose) Kearney & Peebles (1939) (*nom. illeg.*, Art. 53.1) ≡ *Dudleya pulverulenta* var. *arizonica* (Rose) S. L. Welsh (1987); **incl.** *Echeveria lagunensis* Munz (1932) ≡ *Dudleya lagunensis* (Munz) E. Walther (1932).

[1] Differs from ssp. *pulverulenta*: Stems 1 - 4 cm Ø; **Ros** with 15 - 25 **L**; **L** oblong-ob lanceolate to oblong-ovate, usually long-attenuate, (3-) 5 - 15 (-17) × 1 - 5 (basally 1 - 3.5) cm, 2 - 4 mm thick, glaucous, usually not densely and persistently farinose; **Inf** scapes 15 - 60 cm, 2 - 6 mm Ø; **Inf** with 3 - 6 scorpioid **Br**, these ascending, 4 - 27 cm, with 3 - 6 **Fl**; **Ped** usually erect to ascending, 5 - 15 (-20) mm; **Cal** lobes acute; **Pet** 9 - 15 mm, red or apricot-yellow, tube 4 - 8 mm, lobes 1.5 - 2 mm wide. – *Cytology*: n = 17.

Basically a smaller-growing subspecies from the dry desert mountains, and with less densely farinose leaves (Moran 1943b).

D. pulverulenta ssp. **pulverulenta** – **D:** USA (S Nevada, S-C and C California, W Arizona), Mexico (N Baja California, N Sonora); cliffs, canyons and slopes to 1500 m, flowers June to September. **I:** Moran (1943b); Bartel (1993: 533); Thomson (1993: pl. 24: 1-4, 33: 1-4, 39: 5).

Incl. *Echeveria argentea* Lemaire (1863); **incl.** *Echeveria silverado splendens* hort. (1939) (*nom. inval.*, Art. 23.1, 29.1); **incl.** *Dudleya pulverulenta* ssp. *typica* Moran (1943) (*nom. inval.*, Art. 24.3).

[1] Plants usually densely and completely farinose; stems 4 - 9 cm Ø; **Ros** large, with usually 40 - 60 **L**; **L** oblong, usually broadest in the upper ½, delicately pointed to abruptly acutely pointed, 8 - 25 (-27) × 3 - 10 (basally 3 - 8) cm, farinose; **Inf** scapes 30 - 80 (-100) cm, 5 - 15 mm Ø; **Inf** with 3 - 6 or more not or 1× branched scorpioid **Br**, these ascending to divaricate, 10 - 40 cm, with 10 - 30 **Fl**; **Ped** pendent in the bud stage, erect at fruiting time, 5 - 30 (-35) mm; **Cal** lobes triangular to triangular-ovate, acute to weakly obtuse, basally not broadened, usually erect; **Pet** 11 - 19 mm, deep red, tube 6 - 10 mm, lobes acute to obtuse, 2 - 4 mm wide. – *Cytology:* n = 17.

D. pulverulenta s.l. is distinguished from all other species of the USA by the long flower tube, which otherwise makes up ½ to max. ⅓ of the total petal length (Moran 1943b).

D. rigida Rose (Bull. New York Bot. Gard. 3(9): 23, 1903). **T:** Mexico, Baja California (*McClelland* s.n. in *Rose* 4038 [US 397537, NY, UC]). – **D:** Mexico (S Baja California: Sierra de la Laguna); 1450 - 1900 m. **I:** Moran (1987); Thomson (1993: pl. 36: 1).

≡ *Cotyledon rigida* (Rose) Fedde (1904) ≡ *Echeveria rigida* (Rose) A. Berger (1930).

[1] Stems erect, to > 10 × 1 - 3.5 cm; **Ros** 6 - 15 cm Ø, with 10 - 25 **L**, to 20 in lax cushions to 25 cm Ø; **L** oblong to triangular-ovate, delicately pointed, 5 - 8 × 2.5 - 4 cm, green or somewhat glaucous; **Inf** scape 30 - 60 (-75?) cm, rose-coloured to red, somewhat glaucous; **Inf** glaucous, rose-coloured to becoming red, with 2 - 3 scorpioid **Br**, these 4 - 23 cm, with 8 - 21 **Fl**; **Bra** reddish; **Ped** ± pendent at anthesis, 4 - 10 (-15) mm; **Cal** 4 - 7 mm, lobes appressed, triangular, acute 2 - 5 mm; **Pet** oblong to oblong-oblancheolate, ventrally canaliculate, dorsally bluntly keeled, 9 - 16 × 2.5 - 3.5 mm, basally yellow or yellowish-green, apically red or strongly marked with red, glaucous, tube ± 3.5 - 5 mm, lobes broadly acute; **Anth** reddish; **NSc** white; **Ca** 7 - 8.5 mm, basally greenish-white, towards the tips increasingly marked with red; **Sty** 1.5 - 2 mm, red. – *Cytology:* n = 136.

D. rigida has the highest chromosome number of any species of the genus. The species was lost for a long time but has been rediscovered by Moran (1987). Its relationships within Subgen. *Dudleya* are unresolved.

D. rigidiflora Rose (Bull. New York Bot. Gard. 3(9): 18, 1903). **T:** Mexico, Baja California (*Anthony* 142 [US, F, GH, NY, UC]). – **D:** Mexico (Baja California); only known from the type locality.

≡ *Cotyledon rigidiflora* (Rose) Fedde (1904) ≡ *Echeveria rigidiflora* (Rose) A. Berger (1930).

[1] **Ros** and **L** unknown; **Inf** scape 30 - 40 cm; **Inf** with several usually 2× branched scorpioid **Br**, these 7 - 12 cm, with 10 - 15 **Fl**; **Ped** 2 - 5 mm; **Cal** lobes triangular, acute to long attenuate, 5 - 7 mm; **Pet** slenderly pointed, 10 - 13 mm, tube 4 - 5 mm; **Ca** erect, 10 - 12 mm; **Sty** ± 2 mm.

A hardly known species of unclear affiliation (Moran 1951a).

D. rubens (Brandeggee) Britton & Rose (Bull. New York Bot. Gard. 3(9): 23, 1903). **T:** Mexico, Baja California Sur (*Brandeggee* s.n. [UC, CAS]). – **D:** Mexico (S Baja California: Sierra San Francisco to Sierra La Giganta); mostly N-exposed volcanic cliffs, 500 - 1200 m, flowers April to May. **I:** Nakai (1988b).

≡ *Cotyledon rubens* Brandeggee (1889) ≡ *Echeveria rubens* (Brandeggee) A. Berger (1930).

[1] Stems 5 - 15 (-30) × 1 - 2.5 cm; **Ros** 6 - 11 cm Ø, with 10 - 20 **L**, solitary or few (rarely up to 25) together; **L** oblong to oblong-lanceolate, rarely obovate, acute to delicately pointed or rarely long-attenuate, 3 - 7 × 1 - 2 cm, farinose; **Inf** scapes ascending to erect, 7 - 20 cm, reddish; **Inf** reddish, with 2 - 3 ascending not or 1× branched scorpioid **Br**, these 2 - 12 cm, with 2 - 12 **Fl**; **Ped** ascending to erect, lowermost **Ped** 4 - 10 mm; **Cal** 4 - 8 mm, lobes triangular to lanceolate, acute to long-attenuate, 3 - 6 × 2 - 4 mm; **Cl** 4.5 - 7 (basally) to 4 - 7 (apically) mm Ø; **Pet** oblong, erect, 8 - 15 × 1.5 - 3 mm, reddish to apricot-coloured, tube 5 - 7 mm, lobes partly apically somewhat spreading; **Ca** erect, 7 - 12 mm; **Sty** 2 - 3.5 mm. – *Cytology:* n = 34, 51, 68.

Apparently the only species of the genus in N Baja California Sur at altitudes above 500 m. It is similar to *D. pulverulenta* ssp. *arizonica* but is distinguished by the branching pattern, the smaller number of bracts, shorter inflorescences, shorter pedicels and a higher chromosome number. Differences to the equally similar *D. cymosa* are the more than 10 cm long stems, shorter pedicels, petals fused for more than ⅓ of their length, and the polyploid chromosome number (Nakai 1988b).

D. saxosa (M. E. Jones) Britton & Rose (Bull. New York Bot. Gard. 3(9): 15, 1903). **T:** USA, California (*Jones* s.n. [POM, DS, NY, PH, UC, US]). – **D:** USA, Mexico.

≡ *Cotyledon saxosa* M. E. Jones (1898) ≡ *Echeveria saxosa* (M. E. Jones) Nelson & Macbride (1913) ≡ *Cotyledon lanceolata* var. *saxosa* (M. E. Jones) Jepson (1925) (*incorrect name*, Art. 11.4) ≡ *Echeve-*

ria lanceolata var. *saxosa* (M. E. Jones) Jepson (1936).

D. saxosa ssp. **aloides** (Rose) Moran (Madroño 14(3): 108, 1957). **T:** USA, California (*Orcutt* s.n. in *Rose* 583 [US, NY]). – **D:** USA (California: Peninsular Ranges, Desert Mountains), Mexico (N Baja California); shady rock slopes, 240 - 1700 m, flowers April to June. **I:** CSJA 56: 147-148, 1984; 58: 111-115, 1986; Bartel (1993: 533); Thomson (1993: pl. 3: 1, 9: 1).

≡ *Dudleya aloides* Rose (1903) ≡ *Cotyledon aloides* (Rose) Fedde (1904) ≡ *Echeveria aloides* (Rose) A. Berger (1930) ≡ *Dudleya lanceolata* var. *aloides* (Rose) Munz (1935) ≡ *Dudleya lanceolata* ssp. *aloides* (Rose) Moran (1951) (*nom. inval.*, Art. 29.1); **incl.** *Dudleya delicata* Rose (1903) ≡ *Cotyledon delicata* (Rose) Fedde (1904) ≡ *Echeveria delicata* (Rose) A. Berger (1930); **incl.** *Dudleya grandiflora* Rose (1903) ≡ *Cotyledon grandiflora* (Rose) Fedde (1904) (*nom. illeg.*, Art. 53.1) ≡ *Echeveria grandiflora* (Rose) A. Berger (1930); **incl.** *Dudleya lanceolata* var. *composita* Jepson (1936); **incl.** *Dudleya alainae* Reiser (1984); **incl.** *Dudleya tegelbergii* P. H. Thomson (1993).

[1] Differs from ssp. *saxosa*: Stems erect, short, to 4 × 1 - 3 cm; **Ros** 4 - 15 cm Ø, with 15 - 40 **L**, cushion-forming; **L** densely arranged, erect, oblong-lanceolate, acute, delicately pointed, 3.5 - 15 × 0.6 - 2 (basally 1 - 2.5) cm, young farinose, old glaucous; **Inf** scapes 8 - 35 (-40) cm, glaucous; **Inf** usually flat and congested, 4 - 7 cm Ø, with 3 - 5 ascending often 2 - 3× branched scorpioid **Br**, these undulate, 1 - 12 cm, with 2 - 20 **Fl**; **Ped** 3 - 8 (-20) mm; **Cal** 2 - 3 mm; **Pet** elliptic-oblong, 8 - 15 (-20) × (2.5-) 4 - 5 mm, greenish to bright yellow, rarely red-tinged, tube 1.5 - 3 mm; **NSc** pale yellow; **Ca** erect, 7 - 9 mm, basally fused for ± 5 mm. – *Cytology*: n = 17.

D. tegelbergii seemingly belongs here, esp. because Moran (1951a: 183) cites material from its range (Ord Mts.) here. See also under *D. virens* ssp. *virens*.

D. saxosa ssp. **collomiae** (Rose ex Morton) Moran (Madroño 14(3): 108, 1957). **T:** USA, Arizona (*Collom* s.n. [US, GH?, NY]). – **D:** USA (C Arizona); 600 - 1800 m. **I:** Thomson (1993: pl. 19: 1).

≡ *Dudleya collomiae* Rose ex Morton (1934) ≡ *Dudleya saxosa* var. *collomiae* (Rose ex Morton) hort. (s.a.) (*nom. inval.*, Art. 29.1) ≡ *Echeveria collomiae* (Rose ex Morton) Kearney & Peebles (1939).

[1] Differs from ssp. *saxosa*: Stems 1.5 - 3 cm Ø; **Ros** with 12 - 20 **L**; **L** 6 - 15 × 1 - 2 (-2.5) (basally 1 - 2.5) cm; **Inf** scape 15 - 40 cm, scorpioid **Br** 3 - 12 cm, with 4 - 12 **Fl**; **Cal** 5 - 8 mm, lobes 4 - 7 mm; **Pet** 12 - 18 (-20) × 3 - 4 mm, usually bright yellow, tube 1 - 4 mm. – *Cytology*: n = 68.

Apart from *D. pulverulenta* ssp. *arizonica*, this is the only taxon of *Dudleya* occurring in Arizona.

D. saxosa ssp. **saxosa** – **D:** USA (California: N Desert Mts., W Panamint Mts.); N-exposed granite or limestone slopes, 1100 - 2200 m, not frequent, flowers April to June.

[1] Stems short, 1 - 1.5 cm Ø; **Ros** 3 - 10 cm Ø, with 10 - 25 **L**, solitary or up to 10 together; **L** oblong to oblong-lanceolate, acute, weakly attenuate, 3 - 9 × 0.5 - 1.5 cm, young glaucous, later ± green; **Inf** scape 5 - 20 cm, red; **Inf** obpyramidal, often reddish, mostly 4 - 10 cm Ø, with 2 - 3 not or usually 1× branched scorpioid **Br**, these not curved, 1 - 4 cm, with 2 - 9 **Fl**; **Ped** 5 - 20 mm; **Cal** 4 - 6.5 mm, lobes triangular, acute, 2.5 - 6 mm; **Pet** oblong-lanceolate or oblong-oblong-lanceolate, 9 - 12 × 2.5 - 4 mm, bright yellow, often marked with red and thus appearing orange, tube 1 - 2.5 mm, lobes apically recurved, acute; **NSc** whitish; **Ca** erect, 5.5 - 9.5 mm, green; **Sty** 1 - 1.5 mm. – *Cytology*: n = 68, 85.

D. ×semiteres (Rose pro sp.) Moran (Leaflet. West. Bot. 6: 55, 1950). **T:** Mexico, Baja California (*Orcutt* s.n. [US]).

≡ *Stylophyllum semiteres* Rose pro sp. (1903) ≡ *Cotyledon semiteres* (Rose) Fedde (1904) ≡ *Echeveria semiteres* (Rose) A. Berger (1930).

= *D. attenuata* ssp. *orcuttii* × *D. brittonii* and/or *D. candida* (see remarks for the first parent taxon).

D. setchellii (Jepson) Britton & Rose (Bull. New York Bot. Gard. 3(9): 15, 1903). **T:** USA, California (*Jepson* 13418 [UCJ]). – **D:** USA (California: SE San Francisco Bay in the Santa Clara County); rocky places in serpentine grassland, 120 - 300 m, rare. **I:** Thomson (1993: pl. 35: 5).

≡ *Cotyledon laxa* var. *setchellii* Jepson (1901) ≡ *Cotyledon setchellii* (Jepson) Fedde (1904) ≡ *Echeveria setchellii* (Jepson) Nelson & Macbride (1913) ≡ *Echeveria laxa* var. *setchellii* (Jepson) Jepson (1936) ≡ *Dudleya cymosa* ssp. *setchellii* (Jepson) Moran (1957).

[1] Stems 1 - 2 cm Ø; **Ros** few; **L** oblong-oblong-lanceolate to oblong-triangular, acute to pointed, 3 - 8 (-10) × (0.5-) 0.7 - 1.5 (-2) cm, ± glaucous; **Inf** scape 5 - 20 (-25) cm; **Inf** with 2 - 3 usually simple ascending scorpioid **Br**, these 1 - 5 cm, with 4 - 10 **Fl**; **Ped** (2-) 4 - 7 mm; **Cal** lobes triangular, 2 - 5 mm; **Pet** elliptic, margin jagged or not, 8 - 13 × 2.5 - 3.5 mm, pale yellow, keel neither red nor violet, tube 1 - 2.5 mm, tip acute, recurved. – *Cytology*: n = 17.

Intermediate between *D. abramsii* ssp. *murina* and *D. cymosa* ssp. *paniculata* according to Bartel (1993).

D. ×sproulii P. H. Thomson pro sp. (*Dudleya* & *Hasseanthus* Handb., 198-199, t. 47: 3-4, 1993). **T:** USA, California (*Sproul* s.n. [SD, BH]).

See comment under *D. virens* ssp. *insularis*.

D. stolonifera Moran (Bull. South. Calif. Acad. Sci.

48(3): 105-107, ill., 1950). **T:** USA, California (Moran 3095 [UC, CAS, CU, DS, K, MO, NY, POM, US]). – **D:** USA (California: San Joaquin Hills in the Orange County); N-exposed cliffs, rocky places, to 250 m, endangered, flowers May to June. **I:** Bartel (1993: 533); Thomson (1993: pl. 35: 1-2, 36: 2).

[1] Stems > 10 × 1.5 - 3 cm Ø; **Ros** 5 - 12 cm Ø, with 15 - 25 **L**, solitary, but branching by the way of stolons (> 5 cm) from the **Ax** of the lower **L**; **L** oblong-obovate, shortly attenuate-pointed, 3 - 7 × 1.5 - 3 (basally 1 - 2) cm, bright green, not at all glaucous; **Inf** scape 8 - 20 (-25) cm; **Inf** usually with 2 (rarely more) not or rarely 1× branched ascending scorpioid **Br**, these 1 - 6 cm, with 3 - 9 **Fl**; **Ped** 5 - 8 mm; **Cal** 3 - 4 mm, lobes triangular, broader than long, 2 - 3 mm; **Pet** elliptic, 10 - 11 × 3 - 3.5 mm, bright yellow, tube 1 - 2 mm, lobes only apically recurved, acute; **NSc** white; **Ca** divaricate before maturity, 5.5 - 7.5 mm; **Sty** 1.5 - 2 mm. – *Cytology*: n = 17.

This is the only (but see below, *D. alisoensis*) stoloniferous species of the genus. Other species branch almost exclusively dichotomously and the formation of lateral shoots is rare. The species forms hybrids with *D. edulis* according to the protologue and Moran (1951a). The equally stoloniferous *D. alisoensis* from the same geographical range is apparently such a hybrid (though octoploid).

D. traskiae (Rose) Moran (Desert Pl. Life 14: 153, ill., 1943). **T:** USA, California (*Trask* s.n. [US, NY]). – **D:** USA (California: Santa Barbara Island); steep slopes, to 110 m, endangered, flowers May to June. **I:** Desert Pl. Life 15: 10, 1943; Ashingtonia 2: 213, 1979; Thomson (1993: pl. 23: 3, 36: 3-4).

≡ *Stylophyllum traskiae* Rose (1903) ≡ *Cotyledon traskiae* (Rose) Fedde (1904) ≡ *Echeveria traskiae* (Rose) A. Berger (1930).

[2] Stems erect, short, 1 - 2 (-3) cm Ø; **Ros** 10 - 20 cm Ø, with 25 - 35 **L**, branched and cushion-forming, sometimes with 20 to > 100 **Ros** together; **L** densely arranged, oblong-oblancheolate, apically acutely pointed to weakly attenuate-pointed, 4 - 15 × 1 - 4 cm, at least young glaucous; **Inf** scape 20 - 30 cm; **Inf** 20 - 30 cm, ± flat-topped, with ± 3 not or up to 2× branched scorpioid **Br**, these 4 - 10 cm, with 7 - 15 **Fl**; **Ped** usually 1 - 4 mm; **Cal** 4 - 5 mm, lobes triangular to triangular-ovate, acute, 2.5 - 4 mm; **Pet** narrowly ovate, basally almost erect, 8 - 10.5 × 3 - 4 mm, bright yellow, becoming somewhat red-veined, tube 1 - 2 mm, lobes apically recurved, acute; **Ca** later somewhat divaricate, 6.5 - 8 mm; **Sty** ± 2.5 mm. – *Cytology*: n = 34.

Distinguished from all other species of Subgen. *Stylophyllum* by the broader and thinner leaves and bright yellow almost erect petals (the last-mentioned character otherwise only present in *D. anomala*), and thus approaching Subgen. *Dudleya* (Mo-

ran 1943a). It originated probably a long time ago as an allopolyploid hybrid between the two subgenera, and this is supported by the intermediate flower shape and the tetraploid chromosome number. Today, no other species are, however, reported from Santa Barbara Island (Moran 1978b).

D. variegata (S. Watson) Moran (Leaf. West. Bot. 7(4): 110, 1953). **T:** USA, California (*Cleveland* s.n. [GH]). – **D:** USA (California: San Diego County: S South Coast, S Peninsular Ranges), Mexico (NW Baja California); dry hills, mesas, to 300 m, not frequent, flowers April to May. **I:** Desert Pl. Life 16: 76, 1945; Thomson (1993: pl. 41: 2-3); CSJA 72: 147, 2000.

≡ *Sedum variegatum* S. Watson (1876) ≡ *Hasseanthus variegatus* (S. Watson) Rose (1903).

[3] Stems ovoid, ± globose to oblong, 1 - 3 × 0.3 - 1.5 cm; **Ros** with 4 - 12 **L**; **L** oblanceolate to spatulate, acute to obtuse, basally attenuate into a slender petiole, 1 - 7 × 0.3 - 1.1 cm, vernal; **Inf** scape 5 - 20 cm, red-striate; **Inf** usually with 2 - 3 simple scorpioid **Br**, these ascending, 2 - 15 cm, with 3 - 11 **Fl**; **Fl** (4- to) 5-merous; **Cal** lobes triangular-ovate or oblong-ovate, acute to ± obtuse, erect, 2 - 3 (-7) mm, green or yellowish; **Pet** elliptic-lanceolate, 5 - 7 × 2.5 - 3.5 mm, pale to deep yellow, sometimes spotted with red and often with red or violet dorsal midstripe, tube ± 0.5 mm, lobes acute; **Ca** erect to slightly divaricate, 4 - 7 mm, basally fused for ± 1 mm, yellowish-green; **Sty** 2 mm; **Fr** red. – *Cytology*: n = 17.

More closely related to *D. multicaulis*, but usually smaller and with fewer leaves that are flattened and basally normally attenuate (Moran 1950). It forms natural hybrids with *D. attenuata* ssp. *orcuttii* (Moran 1951b).

D. verityi K. M. Nakai (CSJA 55(5): 196-197, ill., 1983). **T:** USA, California (*Nakai* 204 [CAS, LA, MO, RSA, SD, US]). – **D:** USA (California: W Santa Monica Mts.); N-exposed volcanic rocks, 60 - 120 m, rare, flowers May to June.

[1] Stems 2 - 10 × 0.2 - 1 cm; **Ros** 2 - 5 (-8) cm Ø, with 6 - 10 **L**, in ± lax (denser in cultivation) cushions 10 - 40 cm Ø and with 25 to > 100 **Ros**; **L** oblong-lanceolate, acute to long-attenuate, upper face flat to slightly concave, lower face rounded, 2 - 5 × 0.4 - 0.8 cm, glaucous; **Inf** scape 5 - 15 cm, lowermost 3 cm **Bra**-less, glaucous, often with violet tinge; **Inf** with 2 - 3 not or usually 1× branched ascending scorpioid **Br** (rarely obpyramidal), **Br** 2 - 5 cm, with 2 - 10 **Fl**; lowermost **Ped** 3 - 5 mm; **Cal** 5 - 7 mm, rounded below, lobes triangular, acute, 3 - 5 × 2 - 2.5 mm; **Cl** tubular, apically somewhat narrowed; **Pet** oblong-lanceolate, 10 - 14 × 2.5 - 4 mm (middle), lemon-yellow, keel slightly green towards the tips, tube 1 - 2 mm, lobes reflexed to 90° or more, acute; **NSc** pale yellow; **Ca** erect, 5 - 7 mm, yellow; **Sty** 1 - 2 mm. – *Cytology*: n = 17.

Erroneously associated with *D. farinosa* or *D. caespitosa* in the past. It differs from the first-mentioned by its smaller size, leaf shape, petal colour and shape and the degree of spreading of the petal tips. Differences from *D. caespitosa* are petal shape and the degree of their spreading, and the diploid chromosome number. It forms natural inter-subgeneric hybrids with *D. blochmaniae* ssp. *blochmaniae* (Nakai l.c.).

D. virens (Rose) Moran (Desert Pl. Life 14: 191, 1943). **T:** USA, California (*Trask* s.n. [US 411238, NY]). – **D:** USA, Mexico.

≡ *Stylophyllum virens* Rose (1903) ≡ *Cotyledon virens* (Rose) Fedde (1904) ≡ *Echeveria virens* (Rose) A. Berger (1930).

D. virens is distinguished within Subgen. *Stylophyllum* by the combination of flattened and non-viscid leaves with white flowers with petals that spread from near the middle (Moran 1995).

D. virens ssp. **extima** Moran (Haseltonia 3: 8, ill. (pp. 6-7), 1995). **T:** Mexico, Baja California (*Moran* 5972 [SD]). – **D:** Mexico (Baja California: Guadalupe Island); cliffs, 250 - 800 m, flowers May to June.

[2] Differs from ssp. *virens*: Stems erect or pendent, to 30 × 1 - 2.5 cm; **Ros** 5 - 15 cm Ø, with 15 - 55 congested **L**, branched and cushion-forming with up to 15 **Ros** together; **L** linear to oblong-oblanolate, narrowly to broadly pointed, 4 - 7 (-17) × 0.6 - 1 (-1.5) (basally 0.5 - 1.5) cm, pale green or farinose; **Inf** scape 5 - 20 cm, 2 - 5 mm Ø, often quite weak; **Inf** 2 - 7 (-12) cm Ø, usually with 2 - 4 densely arranged ascending not or 1× branched scorioid **Br**, these 1 - 6 cm, with 3 - 10 **Fl**; **Ped** 1 - 6 mm; **Cal** 3 - 6 × 3 - 5 mm; **Cl** 12 - 18 mm Ø. – *Cytology*: n = 17, 34.

Differing from the other subspecies by the smaller size (Moran 1995: 8). *D. virens* ssp. *extima* and *D. guadalupensis* are both endemic on Guadalupe Island. These 2 are the *Dudleya* taxa that occur farthest away from the mainland.

D. virens ssp. **hassei** (Rose) Moran (Haseltonia 3: 4, ill. (p. 5), 1995). **T:** USA, California (*Hasse* s.n. [US 411238, F, NY]). – **D:** USA (California: Santa Catalina Island); rocky slopes close to the sea, 5 - 120 m.

≡ *Stylophyllum hassei* Rose (1903) ≡ *Cotyledon hassei* (Rose) Fedde (1904) ≡ *Echeveria hassei* (Rose) A. Berger (1930) ≡ *Dudleya hassei* (Rose) Moran (1957).

[2] Differs from ssp. *virens*: **Ros** 4 - 8 cm Ø, with 15 - 30 **L**, richly branched, forming cushions to 1 m Ø; **L** mostly erect or outcurved, semiterete and apically often terete, linear and hardly or not broadened above the broadened base, acute or acutish, often weakly attenuate, 5 - 10 (-15) × 0.6 - 1 (basally 1.5 - 3) cm, farinose or rarely green; **Inf** scape

10 - 30 cm; **Inf** usually with 2 - 4 densely arranged not or 1× branched scorioid **Br**, these 2 - 10 cm, with 3 - 15 (-29) **Fl**; **Ped** usually 1 - 2 (-5) mm. – *Cytology*: n = 34.

Differences to ssp. *insularis*, which also occurs on Santa Catalina Island, are the smaller size and esp. the narrower semiterete leaves and the shorter inflorescences. The two subspecies apparently form natural hybrids (Moran 1995: 6).

D. virens ssp. **insularis** (Rose) Moran (Haseltonia 3: 2, ill., 1995). **T:** USA, California (*Trask* s.n. [US 411235, F, NY, US]). – **D:** USA (California: Santa Catalina Island: San Pedro Hill); mostly rocks near the coast, 5 - 300 m.

≡ *Stylophyllum insulare* Rose (1903) ≡ *Cotyledon insularis* (Rose) Fedde (1904) ≡ *Cotyledon viscida* var. *insularis* (Rose) Jepson (1925) ≡ *Echeveria insularis* (Rose) A. Berger (1930) ≡ *Echeveria viscida* var. *insularis* (Rose) Jepson (1936) ≡ *Dudleya insularis* (Rose) P. H. Thomson (1993) (*nom. inval.*, Art. 33.2); **incl.** *Dudleya virens* ssp. *skinneri* Moran (1951) (*nom. inval.*, Art. 29.1).

[2] Differs from ssp. *virens*: Stems to 100 × 2 - 6 (-8) cm; **Ros** 10 - 25 cm Ø, strongly branched, forming cushions to 2 m Ø; **L** 6 - 25 × 1 - 3.2 (basally 2 - 4) cm; **Inf** scape 20 - 70 cm, usually farinose, at times green; **Inf** obpyramidal or often cylindrical, **Br** congested above, scorioid, usually with 3 - 8 **Fl**; **Cal** 4.5 - 7 mm Ø; **Cl** 14 - 23 mm Ø. – *Cytology*: n = 17.

The triploid *D. sproullii* is perhaps a natural hybrid of this subspecies with *D. greenei* (n = 34) (Moran 1995: 4).

D. virens ssp. **virens** – **D:** USA (California: San Clemente Island); rock cliffs and slopes, to 400 m, not frequent, flowers (April to) May to June. **I:** Moran (1995: 6). **Fig. XI.f**

Incl. *Stylophyllum albidum* Rose (1903) ≡ *Cotyledon albida* (Rose) Fedde (1904) ≡ *Echeveria albida* (Rose) A. Berger (1930) ≡ *Dudleya albida* (Rose) P. H. Thomson (1993) (*nom. inval.*, Art. 33.2); **incl.** *Dudleya chilensis* P. H. Thomson (1993); **incl.** *Dudleya matsonii* P. H. Thomson (1993).

[2] Stems erect, short, later decumbent, to > 100 × 1 - 3 cm; **Ros** ± 5 - 10 cm Ø, with 20 - 50 **L**, branched and forming cushions to at least 40 cm Ø; **L** triangular-lanceolate to linear-lanceolate, acute, 5 - 10 (-15) × 1 - 1.5 (basally 1.5 - 3) cm, usually green, at times glaucous; **Inf** scape 20 - 45 cm, reddish, 4 - 7 mm Ø; **Inf** erect, obpyramidal, 6 - 15 cm Ø, usually with 3 - 4 densely arranged 1× - 3× branched scorioid **Br**, these 3 - 5 cm, with 5 - 12 **Fl**; **Ped** 2 - 4 mm; **Cal** 3 - 6 × 4 - 5 mm, lobes triangular-ovate, acute; **Cl** 16 - 20 mm Ø; **Pet** triangular-ovate or elliptic-oblong, basally erect, 7 - 11 × 2 - 3.5 mm, white or somewhat marked with red (then appearing pink), keel greenish, tube 1.5 - 2.5 mm,

lobes divaricate or somewhat recurved from near the middle, acute; **NSc** whitish; **Ca** erect to ascending, 6 - 10 mm; **Sty** 2 - 4 mm. – *Cytology*: $n = 17$.

D. chilensis, almost certainly erroneously described from Chile, appears to belong here (Moran 1995: 7). Moran (l.c.) similarly places *D. matsonii* here, although that species is mentioned from the San Jacinto Mts. and differs by more strongly ascending petals. *D. matsonii* perhaps represents a natural hybrid between *D. abramsii* ssp. *abramsii* with *D. saxosa* ssp. *aloides*, which both occur in the San Jacinto Mts.

D. viscida (S. Watson) Moran (Desert Pl. Life 14: 191, 1943). **T**: USA, California (*Nevin* s.n. [GH, DS, PH, UC]). – **D**: USA (California: Orange and San Diego Counties); rocky slopes and cliffs near the sea, to 450 m, rare, flowers May to June. **I**: Moran (1943a: 13); Thomson (1993: pl. 38: 4, 39: 6, 40: 4); KuaS 51: centre page pullout 18, 2000.

≡ *Cotyledon viscida* S. Watson (1882) ≡ *Stylophyllum viscidum* (S. Watson) Britton & Rose (1903) ≡ *Echeveria viscida* (S. Watson) A. Berger (1930).

[2] Stems usually erect and short, 1 - 2.5 (-4) cm Ø; **Ros** 10 - 30 cm Ø, with 15 - 35 **L**, branched and forming cushions; **L** densely arranged, linear-triangular, acute or delicately pointed, 6 - 15 × 0.2 - 1.5 (basally 1 - 2) cm, dark green, strongly glutinous, appearing oily, with resinous scent; **Inf** scape 20 - 40 cm; **Inf** 3 - 18 × 3 - 10 cm, with 3 to many 1 - 2× branched scorpioid **Br**, these 2 - 6 cm, with 3 - 10 **Fl**; **Ped** 0 - 4 mm; **Cal** 3 - 4 mm, lobes triangular-ovate to oblong-ovate, acute, 1.5 - 4 mm; **Pet** elliptic-oblong, basally erect, 6 - 9 × 2.5 - 3.5 mm, white, distinctly red-striate, tube ± 1 - 2 mm, lobes spreading from near the middle or somewhat recurved, acute; **Ca** ascending, weakly divaricate, weakly gibbous, 7 - 9 mm; **Sty** 2.5 - 4 mm. – *Cytology*: $n = 17$.

This is the only *Dudleya* species with strongly viscid leaves, with the exception of the less pronouncedly viscid *D. anomala*.

ECHEVERIA

M. Kimnach

Echeveria De Candolle (PSRV 3: 401, 1828). **T**: *Cotyledon coccinea* Cavanilles [Lectotype, selected by J. N. Rose, Bull. New York Bot. Gard. 3: 5, 1903.]. – **Lit**: Walther (1972). **D**: S USA (Texas), Mexico, C and S America except Guiana, Brazil, Uruguay, Paraguay and Chile. **Etym**: For Atanasio Echeverría (fl. 1787), Mexican botanical artist of Basque origin who made drawings (never published) for Sessé & al., Flora Mexicana.

Incl. *Courantia* Lemaire (1851). **T**: *Courantia echeveroioides* Lemaire [Typification by inference, only element included.].

Incl. *Oliverella* Rose (1903) (*nom. illeg.*, Art. 53.1).

T: *Oliverella elegans* Rose [Typification by inference, only element included.].

Incl. *Urbinia* Britton & Rose (1903). **T**: *Echeveria agavoides* Lemaire.

Incl. *Oliveranthus* Rose (1905). **T**: *Oliverella elegans* Rose.

Perennial succulents, glabrous to hirsute; **R** fibrous or tuberous, stem none or conspicuous and tall, usually branching; **Ros** compact, diffuse or lacking; **L** alternate, rosulate to scattered along the stem, submembranous to highly fleshy, loosely or firmly attached, linear to nearly orbicular but usually lanceolate or oblanceolate, acute to obtuse, usually mucronate, lower face rounded or keeled, upper face concave, flat or convex, often glaucous or highly coloured, sometimes easily falling, rooting and forming new plants; **Inf** lateral, spicate, racemose, or cymose-paniculate with 1 to several cincinni (= **Br** with alternately arranged **Fl**), flowering stem with numerous **Bra** similar in shape to the normal **L** but smaller; **Ped** nearly lacking to long, usually with 1 to several minute bracteoles; **Sep** 5, reflexed to appressed but usually somewhat expanding, ± unequal in size, divided to near base; **Cl** cylindrical to pentagonal; **Pet** 5, imbricate (valvate in Ser. *Valvatae*), expanding slightly only near tip, colour varying from white through yellow and orange to red, inner surface usually yellow, usually with a nectar-cavity at the base; **St** ± included, 10, 5 attached to the **Pet** at the top of the nectar-cavities, 5 attached at the top of the **Cl**-tube between the **Pet**; **Fil** subulate, flattened; **Ca** 5, united basally, erect at anthesis, each with a **NSc** at the base; **Sty** slender; **Sti** minute; **Fr** follicles widely divergent at maturity; **Se** ovoid-pyriform, minute, smooth or reticulate. – *Cytology*: Extremely diverse in number of chromosomes, with every haploid number from $n = 12$ through 34 and with polyploid numbers from 28 to 250.

Many *Echeveria* species are extremely variable and, in the case of the more attractive ones, numerous minor variants were given specific status. A thorough revision of the genus will require much additional field-work. In the present account a number of taxa have been reduced to synonymy or to the rank of variety. These changes were often influenced by the published and unpublished opinions of Reid Moran and Charles Uhl, both specialists in the genus. The cytology of the genus is highly intricate and is useful in determining relationships between species; the chromosome counts cited here are all by Uhl.

Echeverias are generally found at medium to high elevations, only *E. laui* growing as low as 500 m. Some populations of *E. secunda* thrive at over 3000 meters. Most species grow in light shade on rocks or the sides of cliffs. *E. rosea* is normally epiphytic and others occasionally so. *E. heterosepala*, *E. schaffneri* and *E. paniculata* often grow on flat

sandy ground in arid areas, either in full sun or shaded by shrubs.

The cultivation of *Echeveria* ranges from easy (*E. agavoides*, *E. elegans*, *E. secunda*) to difficult (*E. calycosa*, *E. chazaroi*, *E. megacalyx*, *E. pinetorum*, *E. valvata*). As the rainless period in Mexico is during the cool season, less watering at that time is advisable. During summer they remain healthier and show brighter colours if grown in cool areas. Cuttings root easily for most species, and tall-growing species can be started over from apical cuttings, while the base can be kept to form more offsets. Many species propagate easily from leaves or bracts.

The last major revision of *Echeveria* was by Walther (1972). Moran presented a revised division of the genus into series in Jacobsen (1970). These series are followed here except for Ser. *Urceolatae* (a later synonym of Ser. *Urbiniæ*) and Ser. *Induplicatae* Moran, established for *E. linguifolia*, which is, however, here placed in *Cremnophila* according to Moran:

- [1] Ser. *Angulatae* E. Walther 1935: **R** often tuberous; stem nearly lacking; **L** small, narrow; **Inf** with 1 to several cincinni; **Pet** acutely keeled, thick.
- [2] Ser. *Chloranthæ* Moran 1960: Stem nearly lacking; **Inf** with 1 cincinnus; **Ped** short, stout; **Pet** green, obtusely keeled. Only species: *E. heterosepala*.
- [3] Ser. *Ciliatæ* Moran 1961: Stem short to medium long; **L** pubescent to glabrous; **Inf** racemose or paniculate, often pubescent.
- [4] Ser. *Echeveria* (incl. *Oliverella* Rose $\equiv$ *Oliveranthus* Rose $\equiv$ Sect. *Oliveranthus* (Rose) A. Berger; incl. Ser. *Vestitæ* E. Walther): Stem medium to tall; **L** minutely puberulent to hirsute; **Inf** a spike or equilateral raceme, often pubescent.
- [5] Ser. *Gibbifloræ* (Baker) A. Berger 1930 (incl. Ser. *Grandes* E. Walther): Stem short or of medium height; **L** medium to large, glabrous; **Inf** a paniculate cyme (thyrs), the **Br** cincinni, rarely pubescent (*E. semivestita*).
- [6] Ser. *Longistylæ* E. Walther 1959: Stem nearly lacking; **L** glabrous; **Inf** with 1 or 2 cincinni; **Cl** 3 cm long; **Sty** 2 cm long. Only species: *E. longissima*.
- [7] Ser. *Mucronatæ* E. Walther 1935: **R** tuberous; Stem nearly lacking; **L** glabrous, small; **Inf** spicate or subracemose; **Ped** to 2 mm long.
- [8] Ser. *Nudæ* E. Walther 1958 (incl. Ser. *Australiae* E. Walther, incl. Ser. *Elatæ* E. Walther, incl. Ser. *Bracteolatae* E. Walther): Stem tall; **L** glabrous or papillose; **Inf** racemose, rarely spicate.
- [9] Ser. *Occidentales* Moran 1968: **R** not tuberous; stem nearly lacking; **L** small to medium; **Inf** cymose, much-branched apically, with cincinni; **Cl** red.
- [10] Ser. *Paniculatae* A. Berger 1930: **R** not tuberous; stem short; **L** small, glabrous; **Inf** cymose-paniculate, with cincinni; **Cl** very small.
- [11] Ser. *Pruinosæ* E. Walther 1959: Stem short; **L** small to medium, pruinose to glaucous; **Inf** with 1 or 3 cincinni; **Pet** thick.
- [12] Ser. *Racemosæ* (Baker) A. Berger 1930: **R** tuberous or fibrous; stem nearly lacking, more rarely medium tall; **L** usually glabrous, rarely pubescent; **Inf** racemose.
- [13] Ser. *Secundæ* (Baker) A. Berger 1930: **R** not tuberous; stem nearly lacking to short; **L** glabrous, small, usually glaucous; **Inf** with 1 or 2 cincinni; **Pet** obtusely keeled.
- [14] Ser. *Spicatae* (Baker) A. Berger 1930: Stem tall; **L** narrow, glabrous; **Inf** densely spicate or racemose; **Sep** often longer than the **Cl**; **Pet** obtuse, keeled.
- [15] Ser. *Thyrsofloræ* Moran 1968: **R** tuberous; stem nearly lacking; **L** glabrous; **Inf** thyrsoïd, or subracemose and determinate.
- [16] Ser. *Urbiniæ* E. Walther 1935 (incl. Sect. *Urbinia* (Britton & Rose) A. Berger; incl. Ser. *Urceolatae* E. Walther): **R** not tuberous; stem nearly lacking; **L** small, glabrous, often glaucous; **Inf** secund-racemose; **Cl** urceolate.
- [17] Ser. *Valvatæ* Moran 1963: **R** not tuberous; stem nearly lacking; **L** thin, acute-margined; **Inf** with 1 or 2 cincinni; **Bra** imbricate; **Sep** about as long as **Cl**; **Pet** valvate (= not overlapping).

Intergeneric hybrids are known with *Cremnophila* (= $\times$ *Cremneria*), *Graptopetalum* (= $\times$ *Graptoveria*), *Lenophyllum* (= $\times$ *Lenoveria*), *Pachyphytum* (= $\times$ *Pachyveria*), *Sedum* (= $\times$ *Sedeveria*), *Thompsonella* (= $\times$ *Thompsoveria*), and *Villadia* (= $\times$ *Villeveria*). For suspected hybrids with *Dudleya*, see $\times$ *Dudleyeria*.

Hybrids between species of *Echeveria* are frequently found in cultivation. In addition to the few named hybrids included in the account below, the following names also refer to intrageneric hybrids: *E. $\times$ derosa*, *E. $\times$ gossotii*, *E. $\times$ graessneri*, *E. $\times$ haageana*, *E. $\times$ lanceolata* Gossot 1936 (*nom. inval.*, Art. 53.1), and *E. $\times$ setorum*.

The following names are of unresolved application but are referred to this genus: *Echeveria crispata* Lemaire (1851); *Echeveria eximia* De Vos ex Morren (1875); *Echeveria macrophylla* hort. ex Morren (1874) (*nom. inval.*, Art. 32.1c); *Echeveria metallica* var. *rosea* Olbrich (1883); *Echeveria rosaeformis* De Smet ex Morren (1875); *Echeveria tortuosa* hort. ex Morren (1874) (*nom. inval.*, Art. 32.1c); *Echeveria vancelstii* De Smet (1874) (*nom. inval.*, Art. 32.1c); *Echeveria vervlietii* hort. ex Morren (1874); *Echeveria villosa* De Smet (1874) (*nom. inval.*, Art. 32.1c).

E. 'Imbricata' Deleuil (Cat., [], 1873). – **I:** Walther (1972).

Stem short, much-branched; **L** widely obovate, cuspidate, highly concave above, 3 - 5 cm long and wide, glaucous-green, red-margined.

A hybrid by M. Deleuil of Marseilles of *E. glauca* (= *E. secunda*) and *E. gibbiflora* 'Metallica', known since 1873 and still widely planted as a garden plant in warmer areas.

E. 'Set-oliver' E. Walther (CSJA 8: 172, 1937). – **I:** Walther (1972).

Stem to ± 10 cm tall, much-branched; **L** in lax **Ros**, hirsute; **Inf** 40 cm tall; **Cl** 21 × 12 mm Ø, red-yellow.

An attractive hybrid by Victor Reiter of *E. setosa* var. *setosa* with *E. harmsii*, useful in landscaping or as a pot-plant.

E. acutifolia Lindley (Edward's Bot. Reg. 5: t. 29 + text, 1842). **T:** Mexico, Oaxaca (*Anonymus* s.n. [CGE]). – **D:** Mexico (Oaxaca: Cerro Guiengola, Nizanda). **I:** Walther (1972).

≡ *Cotyledon acutifolia* (Lindley) Baker (1869); **incl.** *Cotyledon devensis* N. E. Brown (1906) ≡ *Echeveria devensis* (N. E. Brown) M. L. Green (1931); **incl.** *Echeveria holwayi* Rose (1911).

[5] Stem to 10 cm tall or more, rarely branched; **L** subrhomboid, very acute, upper face concave, mucronate, green but tinged purplish or red; **Inf** narrowly cymose-paniculate, the **Br** short and rigid, with only 3 - 4 **Fl**; **Sep** ascending, linear, ½ as long as the **Cl**; **Cl** urceolate, pentagonal, scarlet tinged with yellow.

An attractive but rarely cultivated Oaxacan species. A variant (distributed as ISI 72) with entirely red leaves was found by T. MacDougall on Cerro Guiengola, and Abisaí García collected a mostly green-leaved form at Nizanda. Keppel (1980: 17) believed that Walther (1972) misinterpreted *E. acutifolia* by citing *Cotyledon devensis* and *E. holwayi* as synonyms and using the latter as a basis for his description of *E. acutifolia*. The two are here tentatively placed in synonymy.

E. affinis E. Walther (CSJA 30(4): 105, figs. 54-55, 1958). **T:** CAS 403156. – **D:** Mexico (Durango, Sinaloa). **I:** Walther (1972).

[9] Stem usually to 5 cm tall (or much taller in the Cerro Surotato form), slowly proliferous; **Ros** 6 - 8 (-22) cm Ø; **L** broadly oblanceolate, shortly acuminate, 3.5 - 7 (-11) × 1.1 - 2.4 (-4) cm, green to nearly black, upper face nearly flat; **Inf** 20 - 30 (-40) cm tall flat-topped cymes with 3 - 5 spreading **Br**, each cincinnus with 4 - 10 **Fl**; **Ped** to 8 mm; **Sep** appressed; **Cl** bluntly pentagonal, 10 × ± 8 mm Ø at the mouth, scarlet-red. – *Cytology*: n = 30, 60.

One of the most attractive species, differing from *E. craigiana* in its green, blackish green or black, usually shorter leaves and less extended inflorescence. The black leaves and red inflorescence form

a striking combination. The Cerro Surotato form has longer stems, larger and greener leaves and a more extended panicle than typical *E. affinis*.

E. agavoides Lemaire (Ill. Hort. 10: Misc. 1: 78, 1863). **T:** [neo - icono]: Saunders Refug. Bot., 1: t. 67, 1869. – **D:** Mexico (San Luis Potosí, Hidalgo, Guanajuato, Durango). **I:** Walther (1972).

≡ *Cotyledon agavoides* (Lemaire) Baker (1869) ≡ *Urbinia agavoides* (Lemaire) Rose (1903); **incl.** *Echeveria yuccoides* Morren (1874); **incl.** *Urbinia obscura* Rose (1903) ≡ *Echeveria obscura* (Rose) A. Berger (1930); **incl.** *Echeveria agavoides* 'Red Edge' E. Walther (1972).

[16] Stem usually 5 - 10 cm tall, 2.5 - 3 cm Ø, usually unbranched; **Ros** 7 - 15 (-35) cm Ø; **L** ± 20, ovate-deltoid, acuminate, 4 - 7 × ± 3 cm near base, ± 5 mm thick, margins rounded and hyaline, green, sometimes reddened along margins or at tip; **Inf** mostly with 2 cincinni, **Br** secund-racemose; **Ped** 8 - 20 (-30) mm, slender; **Sep** < 5 mm, somewhat spreading; **Cl** conoid-urceolate, 10 - 14 × 5 - 8 mm Ø near the base, 5 - 10 mm Ø at the mouth, pinkish to orange-red. – *Cytology*: n = 29, 58.

A vigorous, easily-grown species, much-used in hybridizing. In the 1960s Frank Reinelt of Santa Cruz, California, created many crosses and back-crosses with *E. colorata*, but records of the exact parentages have not survived. *E. agavoides* is also highly variable in habitat and the following cultivars or selections can be recognized:

E. agavoides 'Corderoyi' (Morren) Kimnach (CSJA 70(6): 300, 1998). – **I:** Walther (1972: fig. 31, as var.). **Fig. XII.a**

incl. *Cotyledon corderoyi* Baker (1874) ≡ *Echeveria corderoyi* (Baker) E. Morren (1874) ≡ *Urbinia corderoyi* (Baker) Rose (1903) ≡ *Echeveria agavoides* var. *corderoyi* (Baker) von Poellnitz (1936).

[16] Differs from typical *E. agavoides*: **L** more numerous (60 - 70), smaller, narrower, greyer; **Inf** 3-branched with 15 - 20 **Fl**; **Sep** free to the base; **Cl** only 9 mm long.

Perhaps no longer in cultivation.

E. agavoides 'Ebony' Kimnach & Trager (CSJA 64(2): 88, 1992). – **D:** Mexico (San Luis Potosí). **I:** CSJA 65: 245, 1993.

[16] Differs from typical *E. agavoides*: Stem rarely offsetting; **L** nearly deltoid, 5 - 7 × 3 - 3.5 cm wide near base, slightly recurving, cuspidate-aristate, grey-green, margins and tip purplish to nearly blackish.

A superior clone with dark reddish leaf-margins, the color becoming more pronounced during cool weather. The plant was collected in Mexico, but the exact locality is not known.

E. agavoides 'Multifida' (E. Walther) Kimnach (CSJA 70(6): 300, 1998). **T:** CAS. – **D:** Mexico (San Luis Potosí: Hacienda de San Francisco).

≡ *Echeveria agavoides* var. *multifida* E. Walther (1972).

[16] An untypical and highly attractive clone with bright red leaf margins.

E. agavoides 'Prolifera' (E. Walther) Kimmach (CSJA 70(6): 300, 1998). **T:** CAS.

≡ *Echeveria agavoides* var. *prolifera* E. Walther (1972).

[16] Differs from typical *E. agavoides*: Stem freely branching; **L** to 30 or more, 10 - 12 × ± 3 cm, greenish-yellow; **Cl** to 16 mm long.

E. alata Alexander (CSJA 13: 136, ill., 1941). **T:** Mexico, Oaxaca (*MacDougall* B.16 [NY]). – **D:** Mexico (Oaxaca: Quiotepec near Yolox). **I:** Walther (1972).

[8] Stem to 8 cm tall or more, ± 7 mm Ø; **L** diffuse along the stem or subrosulate, oblanceolate, cuspidate, 3 - 6 × 1 - 2.4 cm, 6 - 8 mm thick, green, margin red; **Inf** racemes 10 - 20 cm; **Ped** 15 - 18 mm; **Sep** strongly ascending, to 11 - 18 mm; **Cl** urceolate, 17 - 22 mm long, sharply 5-angled or 5-winged, scarlet below, yellow at apex. – *Cytology*: n = 17.

A small rather homely shrub but with attractively coloured flowers.

E. amoena De Smet (Cat., [], 1875). **T:** [neo – icono]: *Gartenflora* 53: 206, fig. 30, 1904. – **D:** Mexico (Puebla, Veracruz). **I:** Walther (1972).

Incl. *Echeveria pusilla* A. Berger (1904); **incl.** *Echeveria purpusii* Britton (1905) (*nom. illeg.*, Art. 53.1); **incl.** *Echeveria microcalyx* Britton & Rose (1911).

[10] Stem to 5 cm or more, 3 - 5 mm Ø, branching; **Ros** 2.5 - 5.5 cm Ø; **L** obovate-spatulate, cuspidate, 1 - 2 × 0.7 - 1.5 cm, ± 4 mm thick near tip, glaucous-green, often red-tipped; **Inf** laxly cymose-paniculate with cincinni, ± 10 - 20 cm long; **Bra** minute, 4 - 10 (-20) mm, easily detached; **Ped** slender, 1 - 3 cm; **Sep** slightly spreading, < 3 mm; **Cl** cylindrical, 7 - 9 × ± 4 mm Ø near the base, salmon-orange. – *Cytology*: n = 33, 66.

A diminutive species that drops its bracts at the slightest touch and thus quickly spreads through a collection. *E. microcalyx* differs mainly in having slightly larger leaves.

E. amphoralis E. Walther (CSJA 30(5): 149, ill., 1958). **T:** Mexico, Oaxaca (*MacDougall* B.82 [CAS]). – **D:** Mexico (Oaxaca: Tlaxiaco, Río de Tablas). **I:** Walther (1972).

[4] Puberulous on all parts except inside **Fl**; stem to 20 cm tall or more, branching; **L** subrosulate or somewhat scattered, obovate-cuneate, mucronate, to 3.5 × 2 cm, thickish, subpetiolate, green, margin red; **Inf** racemes to 20 cm with 4 - 7 **Fl**; **Ped** to 2 cm, to 3 mm Ø; **Sep** ascending to widely spreading, to 14 mm, semiterete; **Cl** amphora-shaped, penta-

gonal, to 24 × 14 mm Ø; **Pet** scarlet-red below, yellow along margins and at apex. – *Cytology*: n = 38.

E. angustifolia E. Walther (*Echeveria*, 211, ill., 1972). **T:** Mexico, San Luis Potosí? (*Purpus* 205 [US]). – **D:** Mexico (San Luis Potosí?, Tamaulipas?).

[16] Stem to 3 cm tall or more, not branching; **L** narrowly oblong-oblanceolate, to 4 × 0.7 - 0.9 cm, thick, upper face shallowly concave, acuminate; **Inf** to 20 cm tall, a single cincinnus with 10 - 15 **Fl**; **Ped** 2 - 4 mm; **Sep** widely spreading, to 8 mm; **Cl** sharply pentagonal, ± 11 × 6 - 7 mm Ø near the base, 3 - 4 mm Ø at the mouth, reddish. – *Cytology*: n = ± 200.

Closely resembling *E. bifida*. Uhl (1996b), however, identified 2 plants from Tamaulipas and San Luis Potosí as *E. angustifolia* and found them to be very high polyploids (± 200 chromosomes, in contrast to 12 for the *E. teretifolia* alliance).

E. atropurpurea (Baker) Morren (*Belgique Hort.* 1874: 156, 1874). **T:** Mexico? (*Anonymus* s.n. [K]). – **D:** Mexico (Veracruz?). **I:** Walther (1972).

≡ *Cotyledon atropurpurea* Baker (1870).

[12] Stem to 15 cm long or more, ± 2.5 cm Ø, rarely branching; **Ros** 14 - 20 cm Ø; **L** oblong-oblanceolate or obovate-spatulate, acute, deeply channelled, 10 - 12 × 3 - 5 cm, reddish-brown; **Inf** racemes, 12 - 15 cm; **Ped** 9 - 12 mm; **Sep** 4 mm or more, spreading, linear-lanceolate; **Cl** strongly pentagonal, 12 mm long, red.

Plants of unknown origin but matching the original description are now in cultivation. Easily propagated from bracts.

E. australis Rose (*Bull. New York Bot. Gard.* 3(9): 6-7, 1903). **T:** Costa Rica (*Pittier* s.n. [US]). – **D:** Costa Rica, Panama, Honduras; mostly epiphytic. **I:** Walther (1972).

[8] Glabrous subshrubs to 30 cm tall; **L** subrosulate, narrowly obovate-cuneate, obtuse and mucronate to acute, to 7 × > 2 cm, light green, often tinged purplish, glaucous; **Inf** dense racemes or with lower **Br** 2-flowered, to > 25 cm long; **Sep** ascending or spreading, 8 - 12 mm; **Cl** 11 - 14 mm long, strongly pentagonal, red. – *Cytology*: n = 28.

Cultivated plants are highly sensitive to cold.

E. bakeri Kimmach (CSJA 63(5): 254-257, ill., 1991). **T:** Bolivia, Cochabamba (*Baker* 5159 [HNT, LP, MO, US]). – **D:** Bolivia (Cochabamba: between Aiquile and Mizque).

[12] Stem usually < 10 cm high, 7 - 12 mm Ø; **Ros** usually single; **L** rosulate, oblanceolate, subacute, 8 - 11 × 2.5 - 3 cm, glaucous-white or -reddish; **Inf** racemes to 50 (-90) cm; **Bra** conspicuous, glaucous; **Ped** ascending near base, recurving towards tip, 9 - 22 mm; **Sep** appressed, 4 - 8 mm; **Cl**

ovoid, pentagonal, 12 - 20 mm long, pinkish-orange. – *Cytology*: $n = \pm 160$.

E. ballsii E. Walther (CSJA 30(2): 44, ill., 1958). **T**: Colombia, Boyaca (*Balls* 7587 [CAS]). – **D**: Colombia (Boyaca, Cundinamarca). **I**: Walther (1972).

[12] Stem < 5 cm long, branching; **Ros** ± 7 cm $\emptyset$; **L** oblong-obovate, subacute, to $3.5 \times \pm 1$ cm, thickish, green; **Inf** racemes 25 - 30 cm with ± 10 nodding **Fl**; **Ped** to 1 cm; **Sep** ascending; **Cl** $12 \times \pm 8$ mm $\emptyset$, orange-red to scarlet. – *Cytology*: $n = \pm 40$.

E. bella Alexander (CSJA 13: 133, ill., 1941). **T**: Mexico, Chiapas (*MacDougall* s.n. [NY]). – **D**: Mexico (Chiapas).

E. bella fa. **bella** – **D**: Mexico (Chiapas: near San Felipe Ecatepec, Zinacatán, Nabenchauk). **I**: Walther (1972: 357).

[12] Stem < 5 cm long, much-branched; **Ros** 3 - 4 cm $\emptyset$; **L** linear-oblongate, acute, to $2.8 \times < 0.5$ cm, green; **Inf** racemes to 25 cm, with 10 - 12 **Fl**; **Ped** to 7 mm; **Sep** widely spreading to slightly ascending, linear, ± 6 mm; **Cl** bluntly pentagonal, $\pm 10 \times 6$ mm $\emptyset$, coral-red below, yellow towards apex. – *Cytology*: $n = 15$.

A free-flowering species of rather difficult culture.

E. bella fa. **major** (E. Walther) Kimnach (Hastoria 5: 51, 1998). **T**: Mexico, Chiapas (*MacDougall* B.180 [CAS]). – **D**: Mexico (Chiapas: near Panamerican Highway on road to Ocosingo). **I**: Walther (1972: 358).

$\equiv$ *Echeveria bella* var. *major* E. Walther (1972).

[12] Differs from fa. *bella*: **L** to 8×2 cm; **Sep** wider and more ascending; **Cl** 11 mm long.

This larger-leaved variant is better regarded as a form than as a variety.

E. bicolor (Kunth) E. Walther (CSJA 7: 39, 1935). **T**: Venezuela (*Humboldt & Bonpland* 610 [P]). – **D**: Venezuela, Colombia.

$\equiv$ *Sedum bicolor* Kunth (1823); **incl.** *Echeveria bracteolata* Link & al. (1842) $\equiv$ *Cotyledon bracteolata* (Link & al.) Baker (1869); **incl.** *Cotyledon subspicata* Baker (1869) $\equiv$ *Echeveria subspicata* (Baker) A. Berger (1930) $\equiv$ *Echeveria bicolor* var. *subspicata* (Baker) E. Walther (1935); **incl.** *Echeveria venezuelensis* Rose (1930).

E. bicolor var. **bicolor** – **D**: Venezuela (Mérida, Tachira, Trujillo, near Caracas), Colombia (Magdalena: Sierra de Santa Marta). **I**: Walther (1972); CSJA 64: 3-4, 1992; 65: 81-87, 1993. **Fig. XII.b**

[8] Stem to 50 cm tall or more, ± 9 - 12 mm $\emptyset$, sparsely branched; **L** scattered, oblanceolate to spatulate, to 7×2.5 cm, upper side concave or

grooved, sometimes slightly glaucous, shiny, green; **Inf** racemes; **Ped** 3 - 4 mm; **Sep** widely spreading, ± 8 mm, green; **Cl** $8 - 10 \times 7 - 9$ mm $\emptyset$ at the mouth, reddish-yellow. – *Cytology*: $n = 21$.

An extremely variable species in growth-form and leaf-shape. Although usually with tall stems, some forms in W Venezuela intergrade with the short-stemmed *E. recurvata*. Upon further study, the little-known *E. subspicata* from Colombia, here treated as a synonym, may prove distinct.

E. bicolor var. **turumiquirensis** Steyermark (Feldiana, Bot. 28: 244, 1952). **T**: Venezuela, Sucre (*Steyermark* 62491 [F]). – **D**: Venezuela (Sucre).

[8] Differs from var. *bicolor*: **Inf** shorter with only 5 - 8 (rather than 12 - 20) **Fl**; **Fl** more crowded, 12 - 14 mm long, deep red.

E. bifida Schlechtendal (Linnaea 13: 411, 1839). **T**: Mexico, Hidalgo (*Ehrenberg* 546 [not located]). – **D**: Mexico (Hidalgo: near Ixmiquilpan, Barranca de Venados, Querétaro?). **I**: Walther (1972).

$\equiv$ *Cotyledon bifida* (Schlechtendal) Hemsley (1880); **incl.** *Echeveria bifurcata* Rose (1909); **incl.** *Echeveria erubescens* E. Walther (1972); **incl.** *Echeveria tenuifolia* E. Walther (1972).

[1] Stem to 6 cm tall or more, ± 1 - 1.5 cm $\emptyset$, usually unbranched; **Ros** 6 - 10 (-20) cm $\emptyset$; **L** lanceolate to rhomboid-oblongate, acuminate, mucronate, $4 - 10 \times 1 - 2.5$ cm, upper face concave to flat, green to purplish; **Inf** single, to 3-branched, cincinni with 6 - 20 **Fl**; **Ped** 1 - 4 (-8) mm; **Sep** to 15 mm, subterete to terete, spreading to reflexed; **Cl** $12 - 17 \times 9 - 11$ mm $\emptyset$ at the base, 4 mm $\emptyset$ at the mouth, reddish or yellowish below, reddish above.

An earlier name for *E. bifida* may be *E. teretifolia* (which see), described from a drawing of an incomplete inflorescence showing nearly terete bracts and nearly sessile flowers. This drawing was chosen by Walther as the lectotype of *E. teretifolia*. However, the characters shown nearly match those of other species (*E. angustifolia*, *E. trianthina*) assigned here to series *Urbinae*, and nothing is known of its leaves; it therefore seems best to abandon the name. Although Walther (1972) recognized 3 other species distinct from *E. bifida*, all have the same chromosome number and differ only in such minor details as stem length, the concavity of the upper leaf face, number of inflorescence branches and length of the pedicels. They all seem better reduced under *E. bifida*.

E. calderoniae Pérez-Calix (Acta Bot. Mex. 38: 9-11, ill., 1997). **T**: Mexico, Guanajuato (*Pérez-Calix & Carranza* 3164 [IEB]). – **D**: Mexico (Guanajuato: Mun. Ocampo).

[13] Stem nearly lacking, branching; **Ros** ± 12 cm $\emptyset$; **L** 20 - 30, lanceolate to narrow-oblongate, acute, with a reddish mucro, $2 - 6 \times 0.5 - 0.9$ cm wide in the middle, 2 - 4 mm thick, green, reddish

with age; **Inf** a cincinnus, 6 - 12 cm long; **Ped** 3 - 9 mm; **Sep** ascending, 3.5 - 10 mm; **Cl** 8 - 12 × 3 - 6 mm Ø near the base, reddish or orange below, yellow above.

Distinct among the *Secundae* because of its narrow nearly linear green leaves.

E. calycosa Moran (CSJA 39(1): 14-16, ill., 1967). **T:** Mexico, Michoacán (Moran 13424 [SD]). – **D:** Mexico (Michoacán: 9 km S of Uruapan); growing in lichens on shaded vertical rocks.

[17] Stem < 4 cm long; **Ros** single, 5 - 10 cm Ø; **L** spatulate, obtuse, slightly mucronate, 2.5 - 5 (-9) × 1.5 - 2.5 (-3.5) cm, light green; **Inf** mostly a single cincinnus, at first nodding, later ascending, to 21 cm long, with conspicuous **Bra** imbricate on young **Inf**; **Ped** 2 - 5 mm; **Sep** ascending, very unequal, to 13 mm; **Pet** valvate; **Cl** 7.5 - 10 mm long, yellow above, orange below. – *Cytology*: n = 31.

A delicate species, among the most difficult to grow.

E. canaliculata Hooker fil. (CBM 1857: t. 4986 + text, 1857). **T:** Mexico, Hidalgo? (*Anonymus* s.n. [K?]). – **D:** Mexico (Chiapas: Motozintla; Oaxaca: La Margarita N of Presa Miguel Alemán). **I:** Walther (1972).

≡ *Cotyledon canaliculata* (Hooker fil.) Baker (1869); **incl.** *Echeveria rubescens* Lemaire (1857) (*nom. inval.*, Art. 34.1c).

[12] Stem to 15 cm long or more, ± 2 cm Ø; **Ros** ± 20 - 25 cm Ø; **L** oblong-oblancheolate, aristate to mucronate, upper face deeply channelled, 10 - 15 × 2.5 - 3 cm, glaucous tinged with purple (type collection) or light green (Oaxaca); **Inf** racemes 35 - 50 cm; **Ped** 6 - 12 mm or more; **Sep** equal, spreading-reflexed; **Cl** 12 - 25 mm long, strongly pentagonal, brick-red – *Cytology*: n = 44.

The original collection is no longer cultivated and the Chiapas collection is unverified. Cultivated plants from the cited Oaxaca locality differ in their green leaves and smaller corolla.

E. cante Glass & M. Mendoza-García (CSJA 69(5): 240-241, ill., 1997). **T:** Mexico, Zacatecas (Glass 8073 [CANTE 2501, MEXU]). – **D:** Mexico (Zacatecas: Sierra de Chapultepec). **Fig. XIII.b**

[5] Stem to 10 cm tall, 2 - 3 cm Ø, not branching; **Ros** to 40 cm Ø; **L** oblong-obovate, acute, to 18.5 × 7.2 cm, 6 mm thick, upper face flat to concave, thickly white-pruinose, sometimes tinged lavender, margin reddish; **Inf** 1 - 2, all parts pruinose, cymose-paniculate, 45 - 60 cm, ± 1 cm Ø near the base, **Br** ± 5, each with 4 - 12 **Fl**; **Ped** 2 - 7 (-17) mm, to 4 mm Ø; **Sep** ascending, 10 - 15 mm; **Cl** 20 × 10 - 15 mm Ø near the base, exterior pruinose, orange-pink; **NSc** yellowish tinged pink.

Long confused with *E. subrigida*, which differs in its more succulent, less pruinose, more channelled leaves and in its red nectar scales.

E. carminea Alexander (CSJA 13: 138, ill., 1941). **T:** Mexico, Oaxaca (*MacDougall* s.n. [NY]). – **D:** Mexico (Oaxaca). **I:** Walther (1972).

[4] Plants finely pubescent; stem to 70 cm tall, ± 1 cm Ø, sparsely branched; **Ros** 7 - 10 cm Ø; **L** semirostrate, broadly oblanceolate to obovate, mucronate, long- or short-tapered near base, 4 - 9 × 2 - 4.5 cm, green, margin often reddish, sometimes undulate; **Inf** usually single racemes to 30 cm or more, with ≥ 8 **Fl**; **Sep** widely spreading to recurving, 15 - 20 mm, subterete; **Cl** broadly urceolate, pentagonal, 20 - 25 × 15 - 18 mm Ø, usually orange, yellow along margins of **Pet**, rarely entirely yellow (form from Ayutla). – *Cytology*: n = 21.

A small shrub with unusually showy flowers.

E. carnicolor (Baker) Morren (Belgique Hort. 24: 158, 1874). **T:** [icon]: Refug. Bot., 3: t. 199, 1870. – **D:** Mexico (Veracruz). **I:** Walther (1972: 346-347).

≡ *Cotyledon carnicolor* Baker (1870).

[12] Stem usually < 6 cm long, 1 - 1.5 cm Ø, branching; **Ros** 7 - 10 cm Ø; **L** oblong-oblancheolate, obtuse to subacute, 4 - 7 × 1 - 1.5 cm, 5 - 6 mm thick, densely papillose and glistening, greyish- or purplish-green; **Inf** to 15 cm, equilaterally racemose, often basally branching; **Bra** easily detached and rooting; **Ped** to 8 mm; **Sep** widely spreading, to 6 mm; **Cl** sharply pentagonal, to 10 × 6 mm Ø, salmon-orange above, flesh-colored below. – *Cytology*: n = 18.

Distinctive because of its slightly glistening papillose leaves and short inflorescence.

E. chapalensis Moran & C. H. Uhl (Cact. Suc. Mex. 34(2): 27-34, 48, ill., 1989). **T:** Mexico, Michoacán (Uhl 2140 [SD 95121]). – **D:** Mexico (Jalisco, Michoacán).

[8] Stem to 50 cm high or more, 4 - 12 mm Ø, branching; **Ros** 7 - 14 cm Ø; **L** spatulate-rhomboid, shortly acuminate, mucronate, 5 - 7.5 × 2 - 2.5 cm, finely muriculate-papillose, green, often reddened along margins; **Inf** spicate, 20 - 50 cm, 4 - 7 mm Ø; **Ped** < 0.5 mm long; **Sep** erect and appressed, 8 - 10 mm; **Cl** pentagonal, 13 - 15 × ± 5 - 7 mm Ø near the base, greenish near base except for the rose-coloured keels, rose above. – *Cytology*: n = 45.

Although the species is similar in appearance to *E. waltheri*, their chromosome numbers differ fundamentally.

E. chazaroi Kimnach (CSJA 67(2): 81-84, ill., 1995). **T:** Mexico, Oaxaca (Kinnach & al. 3327 [HNT, MEXU]). – **D:** Mexico (Oaxaca: Mun. Juxtahuaca).

[12] Stem < 5 cm long, sparsely branching; **Ros** 6 - 8 cm Ø; **L** obovate, upper face deeply concave, 3 - 5 × 1.5 - 2 cm at widest part, margin erose, minutely undulate, with a light blue-green band along the edge, bluish-green; **Inf** racemose, ± 45 cm; **Bra** un-

dulate, erose; **Ped** recurving, 2 - 6 × ± 1 mm Ø; **Sep** spreading at a 90°-angle, ovate-oblong, 3 - 5 mm; **Cl** 7 - 9 × 5 - 6 mm Ø near base; **Pet** recurving apically, salmon-pink.

E. chiclensis (Ball) A. Berger (NPF2 18a: 473, 1930). **T:** Peru, Lima (Ball s.n. [K]). – **D:** Peru.

≡ *Cotyledon chiclensis* Ball (1887); **incl.** *Echeveria neglecta* von Pollnitz (1935).

E. chiclensis var. **backebergii** (von Poellnitz) Pino (Haseltonia 9: [in press], 2002). **T** [neo]: Peru, Lima (Kinnach & al. 2902 [HNT]). – **D:** Peru (Lima: near Matucana).

≡ *Echeveria backebergii* von Poellnitz (1935) ≡ *Echeveria chiclensis* fa. *backebergii* (von Poellnitz) Kinnach (1998).

[12] Differs from var. *chiclensis*: **L** and **Inf** densely and conspicuously long-papillose; **Cl** glabrous.

Plants near Matucana are so papillose that they glisten in sunlight.

E. chiclensis var. **chiclensis** – **D:** Peru (Junín, Huanuco, Lima).

[12] **R** thick, fusiform; stem < 5 cm long, branching; **L** ascending, linear to narrowly oblong-ob lanceolate, acuminate, acute, upper face deeply concave, 5 - 15 × 1 - 2.5 cm, glabrous, green; **Inf** racemes, sometimes 2- to 3-branched below, to > 30 cm; **Ped** ± 7 mm; **Sep** ascending; **Cl** 10 (-20) mm long, yellowish-pink. – *Cytology*: n = ± 120.

E. chiclensis and its variety seem difficult to cultivate, perhaps because of their tuberous roots.

E. chihuahuensis von Poellnitz (RSN 38: 29, 1935). **T:** Mexico, Chihuahua (*Endlich* 1232 [B?]). – **D:** Mexico (Sonora, Chihuahua, Durango). **I:** CSJA 52: 57, 60, 1980.

[16] Stem < 5 cm long, ± 1 cm Ø, rarely branching; **L** obovate-oblong to obovate-spatulate, or oblong, 4 - 6 × 3 - 4 cm, cuspidate-mucronate, glaucous-white to greenish-white, margin and tips reddened; **Inf** a cincinnus, 1- (to 5-) branched, to 20 cm; **Ped** to 14 mm; **Sep** very unequal, longest ± 8 mm, appressed or ascending; **Cl** cylindrical, ± 2× as long as thick, ± 14 mm long; **Pet** reddish. – *Cytology*: n = 26, 50.

The species typically has white-glaucous leaves, but in one population (Kinnach & Sánchez-Mejorada 1820, 13 km from Los Altares, Durango, on road from Topia) there were a few plants with dark green leaves.

E. chilonensis (Kuntze) E. Walther (CSJA 7(3): 40, 1935). **T:** Bolivia, Santa Cruz (*Kuntze* 5 [NY]). – **D:** Bolivia (Santa Cruz, Cochabamba, Chuquisaca). **I:** NCSJ 24: 90, 1969.

≡ *Sedum chilonense* Kuntze (1898); **incl.** *Echeveria vanvlietii* van Keppel (1969).

[12] Stem to 10 cm long, ± 5 mm Ø, branching;

Ros 7 - 11 cm Ø; **L** linear- to oblanceolate-oblong, acute, 3 - 7 × (0.5-) 1 - 1.5 cm, reddish-green to green; **Inf** racemes, or subpaniculate below, to 60 cm long or more, the lower **Br** with > 1 **Fl**; **Ped** 2 - 10 mm; **Sep** 5 - 8 mm, ascending-spreading; **Cl** pentagonal, urceolate-cylindrical, ± 13 × 7 mm Ø near the base, 5 - 7 mm Ø at the mouth, yellowish to nearly white. – *Cytology*: n = ± 165.

Unique in the genus for its nearly white flowers. It has recently become cultivated again from plants collected near Anzaldo, Bolivia.

E. coccinea (Cavanilles) De Candolle (PSRV 3: 401, 1828). **T:** [lecto – icono]: Cavanilles, Icon. 2: t. 170, 1793. – **D:** Mexico (Hidalgo, Distrito Federal, Puebla, Oaxaca, Chiapas). **I:** Walther (1972); CSJA 48: 225-229, 1976. **Fig. XII.c**

≡ *Cotyledon coccinea* Cavanilles (1793); **incl.** *Echeveria pubescens* Schlechtendal (1839) ≡ *Cotyledon pubescens* (Schlechtendal) Baker (1869).

[4] Plants velvety pubescent except for the inside of the **Fl**; stem to 60 cm tall or more, 0.5 - 2 cm Ø, sparsely branching; **Ros** 5 - 20 cm Ø; **L** subrosulate, lacking below, oblanceolate to obovate-spatulate, shortly acuminate, upper face concave, 3 - 13 × 2 - 4 cm, green, often reddened, or white-hirsute; **Inf** simple spikes to 70 cm or more; **Ped** ± 2 mm; **Sep** ascending to widely spreading, to 13 - 15 mm; **Cl** scarlet, sharply pentagonal, 9 - 15 × 8 - 9 mm Ø near the base, 7 - 10 mm Ø at the mouth. – *Cytology*: n = 23, 25.

This is the first *Echeveria* species to be published. *E. pubescens*, supposedly with wider leaves, cannot be maintained, because of intergrading forms. Especially wide-leaved plants are found along the Ixtlán-Oaxaca highway and a white-haired form is found near San Luis Atolotitlán, Puebla.

E. colorata E. Walther (*Echeveria*, 91, 1972). **T:** Mexico (*Anonymus* s.n. [CAS]). – **D:** Mexico (Jalisco).

E. colorata fa. **brandtii** (Kinnach) Kinnach (Haseltonia 5: 51, 1998). **T:** Mexico, Jalisco (*Boutin & Brandt* 2150 [HNT]). – **D:** Mexico (Jalisco, near Laguna de Sayula). **I:** CSJA 52: 55-56, 1980, as var.

≡ *Echeveria colorata* var. *brandtii* Kinnach (1980).

[16] Differs from var. *colorata*: **L** linear-ovate, 14 - 16 cm.

This taxon has recently been reported as growing with typical plants and thus deserves no more than form-status.

E. colorata fa. **colorata** – **D:** Mexico (Jalisco). **I:** CSJA 52: 55-62, 1980.

Incl. *Echeveria lindsayana* E. Walther (1972).

[16] Stem < 8 cm long, rarely branching; **Ros** 13 - 20 cm Ø, with up to 40 **L**; **L** ovate to obovate, 5 -

9 × 3 - 5 cm, to 8 mm thick, bluish-glaucous, suffused with red along margins and tip; **Inf** to 30 cm tall, 2- to 3-branched, cincinni to 5 cm, 4- to 6-flowered; **Ped** 5 - 13 mm; **Sep** 1 - 4 mm; **Cl** urceolate, 10 - 14 × 6 - 8 mm Ø; **Pet** acute to obtuse, reddish or orange near the base, yellow to light orange above. – *Cytology*: n = 27.

E. compressicaulis Eggli & N. P. Taylor (Curtis's Bot. Mag., ser. nov., 19: [in press], ill., 2002). **T**: Venezuela, Mérida (Taylor 675 [K]). – **D**: Venezuela (Mérida).

[12] **Br** spreading-ascending, to 20 cm, ± 9 mm Ø, irregularly compressed and angled because of elongate diamond-shaped flattened sections around each **L**-scar; **L** usually diffuse, or subrosulate at the stem tip, elliptic-ovate, subacute, upper face irregularly sculptured by the pressure of younger **L**, ± 4 (-4.8) × 1.2 - 1.8 cm, 7 - 9 mm thick, brownish to purplish-green; **Inf** equilaterally racemose, to 15 (-20) cm, stem compressed like the vegetative stems; **Ped** (3-) 7 - 17 mm; **Sep** spreading, 4.5 mm; **Cl** urceolate to broadly tubular, pentagonal, 9 mm long, 10 mm wide at the base, 4 mm wide at the mouth, orange-yellow with lighter petal margins.

Distinctive because of its purplish-brown leaves and irregularly compressed stems, the latter a character also found to a lesser degree in *E. nodulosa* and *E. multicaulis*.

E. craigiana E. Walther (CSJA 24(1): 28-29, ill., 1952). **T**: Mexico, Chihuahua (Craig & Lindsay 1939/3 [CAS]). – **D**: Mexico (Chihuahua, Sonora). **I**: Walther (1972). **Fig. XII.g**

[9] Stem usually < 5 cm long, ± 15 mm Ø, rarely branching; **L** linear-oblong, semiterete, flat above, rounded below, acuminate, shortly subulate-aristate, 8 - 11 × ± 2 cm, brownish or brownish green, slightly glaucous; **Inf** cymose-paniculate, to < 50 cm, much-branched; **Ped** to 2 cm; **Sep** spreading above, to 9 mm; **Cl** tubular-campanulate, ± 11 × 13 mm Ø at the mouth, red. – *Cytology*: n = 30.

E. crenulata Rose (CUSNH 13(9): 295, 1911). **T**: Mexico, Morelos (Rose & Painter 797 [US 454 957]). – **D**: Mexico (Morelos: near Cuernavaca). **I**: CSJA 7: 138, 1936.

[5] Stem to 10 cm long or more; **L** rhomboid-obovate, to > 10 × 7 cm, 2 cm wide at the base, mucronate to acute, margins flat, or strongly and finely undulate, scarcely crenulate, not glaucous, green, margins dark reddish-brown; **Inf** cymose-paniculate, to > 50 cm tall, with 9 or more short cincinni, each with 4 - 12 **Fl**; **Ped** to 1 cm; **Sep** widely spreading to recurved, to 1 cm; **Cl** urceolate, pentagonal, ± 18 × 12 mm Ø near the base, sometimes to 16 mm Ø at the mouth, pinkish to yellowish.

E. cuencaensis von Poellnitz (RSN 38: 187, 1935).

T: Ecuador (Rose & Pachano 22941 [US]). – **D**: Ecuador (Salle).

[12] Stem unknown; **L** oblong or obovate-oblong, mucronate, to 7 × 2.5 cm, greyish, margins reddish; **Inf** racemes to 20 cm or more, with ± 30 **Fl**; **Ped** 3 mm or more; **Fl** in pairs below, single above; **Sep** appressed, ± 7 mm; **Cl** 12 - 14 mm long, red or yellowish. – *Cytology*: n = ± 100.

It is not certain whether this little-known species is stemless or shrubby. Walther (1972) considered it related to the Peruvian *E. excelsa*, which has short stems, shorter pedicels and a longer corolla.

E. cuspidata Rose (Bull. New York Bot. Gard. 3(9): 9, 1903). **T**: Mexico, Coahuila (Palmer s.n. [US]). – **D**: Mexico (Coahuila, Nuevo León). **I**: Walther (1972).

Incl. *Echeveria parrasensis* E. Walther (1959).

[16] Stem usually to 10 cm long or more, 1.5 - 3 cm Ø, usually unbranched; **Ros** 6 - 22 cm Ø; **L** obovate-cuneate, acuminate, acute, mucronate, upper face flat to slightly concave, 5 - 10 × 2 - 4 (-5) cm, 5 - 10 mm thick, grey-glaucous, often reddish-tinged, esp. along margins and at tip; **Inf** with 1 - 2 (-3) cincinni, to 40 cm long, with 6 - 15 **Fl** on apical 8 - 15 cm; **Ped** 6 - 20 mm; **Sep** appressed to slightly spreading, to 8 mm; **Cl** conoid-urceolate, obscurely angled, to 9 - 15 × 6 - 8 mm Ø near the base, 4 - 5 mm Ø at the mouth, scarlet, often tinged orange. – *Cytology*: n = 31.

Through an oversight, Walther treated *E. parrasensis* as a distinct species belonging to another series. A population near Zaragoza (Nuevo León) has rosettes only some 6 cm wide.

E. dactylifera E. Walther (Echeveria, 179, ill., 1972). **T**: CAS. – **D**: Mexico (Sinaloa, Durango, Jalisco, Aguascalientes).

[5] Stem single, to 5 cm tall or more, ± 3 cm Ø; **Ros** 20 - 40 cm Ø; **L** elliptic-oblong, acute, strongly concave on upper face, 10 - 20 × 5 - 16 cm, reddish to reddish-brown, slightly glaucous; **Inf** cymose-paniculate, 6- to 12-branched, to 1 m tall; **Ped** 1 - 2.5 cm; **Sep** widely spreading or somewhat ascending, to 2 cm; **Cl** narrowly urceolate, 15 - 30 × 17 mm Ø, pinkish below, tinged orange above, interior of each **Pet** with 2 finger-like processes near the base. – *Cytology*: n = 54.

A widely-distributed imposing species with attractive reddish leaves. The plants from Aguascalientes are distinguished by their redder leaf colour and smaller flowers.

E. decumbens Kimnach (CSJA 67(1): 3-5, ill., 1995). **T**: Peru, Cuzco (Baker 4143A [HNT, US]). – **D**: Peru (Cuzco).

[12] Stem < 5 cm tall, branching; **Ros** semiglobose, 4 - 7 cm Ø; **L** oblanceolate, cuspidate, 2 - 3.5 × ± 0.8 cm near base, 3 - 4 mm thick, light green to olive-tan; **Inf** racemes, usually semi-horizontal ex-

cept for the ascending apical portion, 26 - 46 cm, 2 - 4 mm Ø; **Ped** ascending, 1 - 2.5 cm, ± 1 mm Ø; **Sep** appressed, 5 - 7 × 1.5 - 2 mm; **Cl** urceolate, obscurely pentagonal, 13 - 15 × 5 - 6 mm Ø near base; **Pet** expanding, linear-lanceolate, acuminate, acute, 3.5 - 4 mm wide, yellowish-red on apical ½, less red below. – *Cytology*: n = 175 ± 5.

E. derenbergii J. A. Purpus (Monatsschr. Kakt.-kunde 31: 8, ill., 1921). **T**: Mexico, Oaxaca (*Purpus* s.n. [US 593195]). – **D**: Mexico (Oaxaca: Sierra de Mixteca). **I**: Walther (1972). **Fig. XIII.a**

[3] Stem short, multibranching; **Ros** 6 - 8 cm Ø; **L** obovate-cuneate, mucronate, 3 - 4 × 2 - 2.5 cm, 3 - 5 mm thick, light green, ± glaucous, margins and tip often reddish; **Inf** to 4 or more, cincinni to 10 cm, single or sometimes 2, each with 5 or more **Fl**; **Ped** erect, to 12 mm; **Sep** ascending to spreading, subequal; **Cl** erect, 12 - 15 mm long, yellow, keels and tips reddish. – *Cytology*: n = 27.

A popular species for small pots or dish-gardens, as well as for hybridizing.

E. diffractens Kimnach & A. B. Lau (CSJA 53(1): 4-7, ill., 1981). **T**: Mexico, Veracruz (*Lau* 70 [HNT]). – **D**: Mexico (Veracruz).

[12] Stem < 5 cm tall; **Ros** rarely proliferous, 7 - 10 cm Ø, 2 - 3 cm high, flattened; **L** oblanceolate, obtuse, cuspidate, 3.5 - 4.5 × 1 - 1.2 cm at base, 1.7 - 2.2 cm wide above, light pinkish-grey-violet, epidermis smooth; **Inf** racemes, single or 2- to 3-branched, **Bra** conspicuous, easily shed, 10 - 20 × 4 - 9 mm; **Sep** ascending, ovate-lanceolate, 4 - 6 × 1.5 - 2.5 mm; **Cl** conoid-urceolate, angled, 11 - 13 × 6 - 7 mm Ø near the base, orange, often yellow near apex. – *Cytology*: n = 18.

Allied to *E. carnicolor*, differing in its widely oblanceolate, prominently mucronate, thinner, non-papillose pink leaves and orange flowers. The bracts easily detach if touched. The name was originally misspelled 'diffractens'.

E. elegans Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 22, 1905). **T**: Mexico, Hidalgo (*Rose* 960 [US]). – **D**: Mexico (Hidalgo, San Luis Potosí, Guanajuato, Querétaro, Jalisco?). **I**: Walther (1972).

Incl. *Echeveria perelegans* A. Berger (1930); **incl.** *Echeveria potosina* E. Walther (1935); **incl.** *Echeveria elegans* var. *kesselringiana* von Poellnitz (1936); **incl.** *Echeveria albicans* E. Walther (1958); **incl.** *Echeveria hyalina* E. Walther (1958); **incl.** *Echeveria elegans* var. *hernandonis* E. Walther (1972); **incl.** *Echeveria elegans* var. *tuxpanensis* E. Walther (1972).

[16] Stem nearly lacking, branching; **L** densely rosulate, oblong-obovate or obovate-cuneate, acute to truncate, mucronate, upper face flat or concave, 3 - 7.5 × 1 - 3.5 cm, thick, nearly white or greenish-glaucous, sometimes tinged purplish; **Inf** a cincin-

nus, 10 - 15 cm tall; **Ped** to 6 - 14 mm; **Sep** 5 - 10 mm, appressed to expanding; **Cl** conoid-urceolate, 11 - 18 × 8 - 12 mm Ø, rose to pink, slightly glaucous, often yellowish or greenish at apex – *Cytology*: n = 31, 32, 34, 60, 62-63, 96, 120-130.

A species that is both popular and variable, leading to the publication of several weak taxa. They mainly differ in such minor characters as leaf-shape and size, sepal expansion and corolla colour and are placed here in synonymy.

E. eurychlamys (Diels) A. Berger (NPF2 18a: 473, 1930). **T**: Peru, Cajamarca (*Weberbauer* 4056 [B †?]). – **D**: Peru (Cajamarca: Pariocota, Huambos, Chota).

≡ *Cotyledon eurychlamys* Diels (1906).

[12] Stem usually < 10 cm tall, 5 - 10 mm Ø; **Ros** 7 - 9 cm Ø; **L** obovate-oblong, 3.5 - 6 × 1.5 - 3 cm, mucronate, greyish-green, often red-tipped; **Inf** erect straight racemes to 25 cm; **Bra** semi-orbicular, fleshy, 10 - 15 × 6 - 12 mm; **Ped** stout, 2 - 3 mm long; **Sep** ascending, fleshy; **Cl** to 14 - 16 × 6 - 8 mm Ø, coral-red. – *Cytology*: n = ± 80.

Distinguished among South American species by its small fleshy glaucous nearly orbicular bracts.

E. excelsa (Diels) A. Berger (NPF2 18a: 473, 1930). **T**: Peru, Ancash (*Weberbauer* 3149 [B †?]). – **D**: Peru (Ancash: Matarragua, Valle de Nepena); 3600 - 3700 m.

≡ *Cotyledon excelsa* Diels (1906).

[12] Stem very short, 3 - 5 cm Ø; **L** subrosulate, oblong-obovate to oblanceolate, strongly narrowed at base, acute, 12 - 15 × 3.5 - 4 cm; **Inf** ± 1 - 1.2 m, subspicate, narrowly cylindrical; **Bra** few, appressed, remotely-spaced; **Ped** to ± 1 mm long or less; **Sep** ovate, 7 × ± 3 mm; **Pet** lanceolate, acute, 16 - 20 × 5 - 7 mm, scarlet, with paler tips.

A large distinctive species unknown in cultivation.

E. fimbriata C. H. Thompson (Trans. Acad. Sci. St. Louis 20: 20, ill., 1911). **T**: Mexico, Morelos (*Trellease* 674 [MO]). – **D**: Mexico (Morelos). **I**: Walther (1972).

[5] Stem to 50 cm long, 2.5 - 3 cm Ø, single; **L** to 10, laxly rosulate, obovate-spatulate to suboblong, 10 - 20 × 6 - 7 cm, obtuse, mucronate, green to strongly brownish-red, margin on young **L** minutely fimbriate; **Inf** cymose-paniculate, to 60 cm; **Ped** ± 1 cm; **Sep** ascending-spreading, subequal; **Cl** cylindrical-pentagonal, ± 15 mm long, red to pink. – *Cytology*: n = 54.

E. fulgens Lemaire (Hort. Vanhoutt. 1: 8, 1845). **T**: [neo - icono]: Jard. Fleuriste 3: t. 244, 1855. – **D**: Mexico.

≡ *Cotyledon fulgens* (Lemaire) Baker (1869); **incl.** *Echeveria retusa* Lindley (1847) ≡ *Cotyledon retusa* (Lindley) Baker (1869).

E. fulgens var. **fulgens** – **D**: Mexico (México, Jalisco, Michoacán, Oaxaca). **I**: Walther (1972).

[5] Stem to 15 cm long or more, 1 - 2 cm Ø, rarely branching; **Ros** 8 - 15 cm Ø; **L** laxly rosulate, obovate-spatulate, obtuse, mucronate, 8 - 15 × 4 - 7 cm, glaucous-green usually heavily tinged with red or brownish-red, margins often undulate and more darkly reddened; **Inf** cymose-paniculate, ± 15 - 20 cm tall; **Ped** 2 - 6 mm, thick; **Sep** ascending-spreading, to 10 mm; **Cl** 10 - 15 × ± 11 mm Ø near base, peach-red; **Pet** sometimes with an appendage on each side of the **NSc**. – *Cytology*: n = 27, 162.

One of the most variable, widespread and decorative species of *Echeveria*. Petal-appendages similar to those in *E. heterosepala* and *E. dactylifera* are sometimes present.

E. fulgens var. **obtusifolia** (Rose) Kimnach (Haseltonia 5: 51, 1998). **T**: Mexico, Morelos (*Pringle* 7734 [US]). – **D**: Mexico (Morelos, Michoacán). **I**: Walther (1972).

≡ *Echeveria obtusifolia* Rose (1903); **incl.** *Echeveria scopulorum* Rose (1905) ≡ *Echeveria obtusifolia* var. *scopulorum* (Rose) von Poellnitz (1936).

[5] Differs from var. *fulgens*: **L** obovate-cuneate, only 4 - 8 cm long, green (though often with red margin). – *Cytology*: n = 27, 135, 162.

E. gibbiflora De Candolle (PSRV 3: 401, 1828). **T**: [neo – icono]: De Candolle, Mém. Fam. Crass., t. 5, 1828. – **D**: Mexico (Distrito Federal, México, Morelos, Michoacán, Oaxaca), Guatemala. **I**: Walther (1972).

≡ *Cotyledon gibbiflora* (De Candolle) Baker (1869); **incl.** *Echeveria grandifolia* Haworth (1828); **incl.** *Echeveria campanulata* Kunze (1843).

[5] Stem to 30 cm tall, ± 5 cm Ø, rarely branching; **L** broadly obovate-orbicular, to > 25 × 15 cm, obtuse or subacute, mucronate, margins sometimes undulate-crenulate, reddish-green, ± glaucous; **Inf** cymose-paniculate, to > 1 m tall, **Br** ± 12-flowered; **Sep** spreading to ascending, to 11 mm; **Cl** pentagonal, ± 16 × 10 mm Ø near the base, 9 mm Ø at the mouth, glaucous-pink. – *Cytology*: n = 27, 54.

An imposing species common in and around Mexico City. Walther (1972) distinguished plants with narrower, more acute leaves as *E. grandifolia*.

E. gibbiflora ‘**Carunculata**’ (van Laren) Kimnach (CSJA 70(6): 300, 1998). – **I**: Jacobsen (1970: t. 58: 3).

≡ *Echeveria gibbiflora* var. *metallica carunculata* van Laren (*pro var.*) (1932) (*nom. inval.*, Art. 24.2); **incl.** *Echeveria carunculata* hort. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Echeveria grandifolia* ‘Blister Leaf’ E. Walther (1972).

[5] Stem to 30 cm tall or more, 2 - 2.5 cm Ø; **L** oblanceolate, obtuse, ± 10 - 14 × 6 - 8 cm, pinkish, with prominent carunculations along the centre.

A remarkable carunculate form apparently de-

rived from ‘Metallica’; the carunculations appear again in some of the seedlings raised from selfed seed of ‘Carunculata’. The stem elongates much more rapidly than in ‘Metallica’.

E. gibbiflora ‘**Metallica**’ (Lemaire) Kimnach (CSJA 70(6): 300, 1998). – **I**: Laren (1934).

≡ *Echeveria metallica* Lemaire (1863) ≡ *Cotyledon gibbiflora* var. *metallica* (Lemaire) Baker (1869) ≡ *Echeveria gibbiflora* var. *metallica* (Lemaire) Morren (1874).

[5] **L** orbicular, obtuse, mucronate, 18 × 13 cm, purplish-lilac with a glaucous-green margin.

Echeveria ‘Pearl of Nürnberg’ (= ‘Perle von Nürnberg’) is a popular hybrid between ‘Metallica’ and *E. potosina* (= *E. elegans*) created by R. Graeser in the 1930s. Its rosettes are 7 - 10 cm Ø and coloured a deep purplish-red.

E. gibbiflora ‘**Violescens**’ (E. Walther) Kimnach (CSJA 70(6): 300, 1998). – **I**: Walther (1972).

≡ *Echeveria violescens* E. Walther (1958).

[5] Stem to 60 cm tall, sparsely branching; **L** obovate-spatulate, obtuse to emarginate, mucronate, apparently ± as large as in ‘Metallica’, purplish, glaucous; **Bra** broader and more obtuse than in ‘Metallica’; **Ped** 2 - 4 mm; **Sep** narrower and more ascending than in ‘Metallica’; **Cl** rose. – *Cytology*: n = 54.

Walther (1972) considered this as a species differing from *E. gibbiflora* var. *metallica* in several floral characters, but it seems best treated as a cultivar. There is no recorded native habitat.

E. gigantea Rose & Purpus (CUSNH 13: 46, t. 12-14, 1910). **T**: Mexico, Puebla (*Purpus* 414 [US]). – **D**: Mexico (Puebla, Oaxaca). **I**: Walther (1972).

[5] Stem usually unbranched, to 50 cm long, 2 - 3 cm Ø; **Ros** 15 - 20 cm Ø; **L** widely obovate-spatulate, obtuse, apiculate, 15 - 20 × 8 - 10 cm, green, margins purplish red; **Inf** cymose-paniculate, to 1 - 2 m tall, with 7 or more cincinni, each with 7 - 16 **Fl**; **Ped** 2 - 8 mm; **Sep** spreading to recurved, very unequal, to 15 mm; **Cl** pentagonal, 12 - 17 × 9 - 11 mm Ø, rose-red, faintly glaucous. – *Cytology*: n = 54.

An attractive species, much hybridized and selected for increased crenulation of the leaf-margins. Outstanding selections of *E. gigantea*, or hybrids of it, were created by two Californians, Harry Butterfield and Dick Wright. Among the latter’s cultivars are ‘Alta May’, ‘Arlie Wright’, ‘Chantilly’, ‘Cameo’, ‘Dick Wright’, and ‘Paul Bunyan’, the last 3 being carunculate as well as crenulate.

E. ×gilva E. Walther (CSJA 7: 61, 1935). **T**: CAS. – **I**: Walther (1972: 116).

Stem short, much-branched; **L** obovate-oblong, 5 - 8 × 2 - 2.5 cm, thick, shortly acute and apiculate, amber-coloured; **Cl** pink.

A hybrid of unknown origin, probably with *E. agavoides* as one parent. It is an excellent landscape plant in frost-free areas.

E. globuliflora E. Walther (CSJA 31(1): 24, ill., 1959). **T:** Mexico, Oaxaca (*MacDougall* B.79 [CAS]). – **D:** Mexico (Oaxaca: Tehuantepec, Cerro Jilotepec); ± 2100 m. **I:** Walther (1972).

[8] Stem to 10 cm long or more, sparsely branching; **L** subrosulate, oblong-ob lanceolate to obovate-cuneate, mucronate, acute or shortly acuminate, $\pm 5 \times 1.5$ cm, green, lower face, edges and keel reddish; **Inf** irregularly cymose-paniculate, to 25 cm long, lower **Br** few, short, each with 2 - 6 **Fl**; **Ped** to 1 cm or more; **Sep** strongly ascending to appressed, longest 4 - 5 mm; **Cl** globose-urceolate, pentagonal, to 10×8 mm $\varnothing$; **Pet** apiculate, orange-red. – *Cytology*: $n = 42$.

The type locality was originally given incorrectly as Cerro Arenal, Oaxaca.

E. globulosa Moran (CSJA 38(1): 12-14, ill., 1966). **T:** Mexico, Oaxaca (*MacDougall* B.235 [SD]). – **D:** Mexico (Oaxaca: Mun. Tlacolula); 2700 - 3000 m.

[3] Stem < 3 cm long, ± 9 mm $\varnothing$, branching; **Ros** nearly globose, 4 - 5.5 cm $\varnothing$; **L** cuneate-spatulate, obtuse to subtruncate, mucronate, 2 - 2.5×0.9 - 1.2 cm, 4 - 4.5 mm thick, glaucous, margins and keel reddish; **Inf** a solitary cincinnus 6 - 8 cm long with 8 - 10 **Fl**; **Ped** 7 - 12 mm; **Sep** slightly ascending, nearly equal; **Cl** pentagonal-ovoid, 9 - 12 mm long, watermelon pink except for the yellow tips. – *Cytology*: $n = 24$.

A dainty species, allied with *E. derenbergii*.

E. goldmanii Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 17, 1905). **T:** Mexico, Chiapas (*Goldman* 04/802 [US 399990, BH, F, GH, NY, UC, US]). – **D:** Mexico (Chiapas: near Pasitán).

[8] Plants glabrous; stem branching, to 20 cm tall; **L** laxly rosulate, linear- or oblong-lanceolate, 3 - $5 \times \leq 1$ cm, acute, deeply concave above, glossy, green, tip and margins reddish; **Inf** 2 to many, spicate, to 25 cm long; **Ped** < 3 mm, thick; **Sep** ascending to appressed, to 5 mm, thick; **Cl** $\pm 10 \times 6$ mm $\varnothing$ near the base; **Pet** hardly spreading at the tips, rose- to scarlet-red.

E. gracilis Rose ex E. Walther (CSJA 7: 40, ill., 1935). **T:** Mexico, Puebla (*Purpus* 24 [US]). – **D:** Mexico (Oaxaca, Puebla). **I:** Walther (1972).

[8] Stem branching, to 20 cm long, 4 - 8 mm $\varnothing$; **L** subrosulate or scattered, cuneate-spatulate, obtuse to rounded, mucronate, 2 - 3.3×0.9 - 1.5 cm, 2.5 - 3.5 mm thick, green or slightly glaucous; **Inf** racemes, 13 - 26 cm; **Ped** 5 - 10 mm; **Sep** widely spreading, linear-lanceolate, nearly equal, 5 - 10 mm; **Cl** pentagonal, 9 - 11×5 - 6 mm $\varnothing$ near the base, red and orange. – *Cytology*: $n = 24$.

Walther's description is of a plant of unknown origin apparently not conspecific with the type collection of *E. gracilis* (Moran 1973). The description above is based on a MacDougall collection from near the type locality. According to Moran, the species is closest to *E. nuda* and *E. guatemalensis*.

E. grisea E. Walther (CSJA 9: 165, ill., 1938). **T:** Mexico, Guerrero (*Walther* 35/1 [CAS]). – **D:** Mexico (Guerrero: Petatlán - Chilapa; Michoacán: Uruapan?). **I:** Walther (1972).

[5] Stem to 10 cm long or more, ± 1.5 cm $\varnothing$, usually unbranched; **Ros** ± 15 cm $\varnothing$; **L** widely obovate-spatulate, obtuse, minutely mucronate, 10 - 15×5 - 8 cm, grey-green, slightly pruinose; **Inf** to 50 cm, cymose-paniculate, with 3 - 5 short few-flowered **Br**; **Ped** to 4 mm; **Sep** widely spreading, subterete, to 7 mm; **Cl** to $13 \times \pm 9$ mm $\varnothing$; **Pet** fleshy, pinkish. – *Cytology*: $n = 27$.

E. guatemalensis Rose (CUSNH 12(9): 395, t. 47, 1909). **T:** Guatemala (*Maxon* 3726 [US 399713]). – **D:** Guatemala, Honduras, Nicaragua. **I:** Walther (1972).

[8] Usually epiphytic glabrous shrublets to 25 cm tall; **L** not rosulate but scattered along the stem, spreading, oblong-ob lanceolate to spatulate, 2 - 4.5×1.5 - 2 cm, obtuse, mucronate, green, reddish in strong light; **Inf** racemes with 15 - 20 **Fl**; **Ped** to 9 mm; **Sep** spreading to ascending, to 10 mm; **Cl** ± 12 mm long and $\varnothing$, rose; **Pet** margins yellow. – *Cytology*: $n = 26$.

E. halbingeri E. Walther (CSJA 30(3): 89, ill., 1958). **T:** Mexico, Hidalgo (*Anonymus* s.n. [CAS]). – **D:** Mexico (Hidalgo).

E. halbingeri var. **goldiana** (E. Walther) Kimnach (*Haseltonia* 5: 51, 1998). **T:** Mexico, Hidalgo? (*Anonymus* s.n. [CAS]). – **D:** Mexico (probably Hidalgo). **I:** Walther (1972).

$\equiv$ *Echeveria goldiana* E. Walther (1959).

[16] Differs from var. *halbingeri*: Stem rarely branching; **L** widely obovate-cuneate, truncate, minutely mucronate, very thick, $\pm 4 \times 2.5$ cm near tip, < 1.5 cm wide near base, green; **Ped** to 15 mm; **Sep** expanded at 90° relative to **Ped**; **Cl** attenuate, only 4 mm $\varnothing$ at the mouth, rose, tip yellow.

According to Walther, this plant was received from Dudley Gold and was reputedly collected in the Valle de Bravo, State of México. Gold later disclaimed any knowledge of the plant, which seems more likely to have been found in Hidalgo. It differs from var. *sanchez-mejoradae* in its smaller more turgid leaves, widely expanded sepals, and attenuated corolla.

E. halbingeri var. **halbingeri** – **D:** Mexico (Hidalgo: S of Actopán, El Arenal, Cerro de las Canteras). **I:** Walther (1972).

[16] Stem nearly lacking, branching; **Ros** 5 - 6 cm Ø, caespitose; **L** densely crowded, obovate, $\pm 2.5 \times 1.3$ cm, obtuse, minutely aristate-apiculate, glaucous-green; **Inf** a single cincinnus to 12 cm; **Ped** 6 mm; **Sep** ascending to spreading, to 6 mm; **Cl** urceolate-campanulate, ± 12 mm long; **Pet** subulate-apiculate, tips strongly recurved, reddish-orange to yellowish. – *Cytology*: $n = 62$.

E. halbingeri var. **sanchez-mejoradae** (E. Walther) Kimnach (Haseltonia 5: 51, 1998). **T**: CAS. – **D**: Mexico (Hidalgo). **I**: Walther (1972).

≡ *Echeveria sanchez-mejoradae* E. Walther (1972).

[16] Differs from var. *halbingeri*: Stem branching freely; **L** linear-oblong to obovate-cuneate, aristate-apiculate, larger, $\pm 6 \times 1.5$ cm, green; **Ped** 9 mm; **Sep** spreading to ascending, to 11 mm; **Cl** 11×8 mm Ø near the base, 5 mm Ø at the mouth; **Pet** pinkish, green at the tips, not recurving. – *Cytology*: $n = 32$.

E. harmsii J. F. Macbride (Field Mus. Nat. Hist., Bot. Ser. 11(1): 22, 1931). **T**: Mexico, México (Rose & Hay 6073 [US]). – **D**: Mexico (reported as native to Oaxaca). **I**: Walther (1972). **Fig. XII.d**

Incl. *Oliverella elegans* Rose (1903) (*incorrect name*, Art. 11.3) ≡ *Cotyledon elegans* (Rose) N. E. Brown (1905) ≡ *Oliveranthus elegans* (Rose) Rose (1905) ≡ *Echeveria elegans* (Rose) A. Berger (1930) (*nom. illeg.*, Art. 53.1).

[4] Plants minutely puberulent on all parts except inside of **Fl**; stem to 30 cm long or more, much-branched; **L** laxly clustered near **Br** tips, widely lanceolate to spatulate, acute, $2 - 3 (-5) \times 1$ cm, green, margins and tips often reddened; **Inf** racemose, 1- to 2-branched, each **Br** with 1 - 3 **Fl**; **Ped** to 3 cm; **Sep** to 18 mm, spreading-upcurving; **Cl** narrowly urceolate, to 33×16 mm Ø; **Pet** scarlet, margins yellow. – *Cytology*: $n = 19$.

A particularly showy-flowering species, much-used in hybridizing.

E. helmutiana Kimnach (CSJA 67(2): 80-81, ill., 1995). **T**: Mexico, Oaxaca (Kinnach & al. 3202 [HNT, GUAD, MEXU]). – **D**: Mexico (Oaxaca: San Isidro Chicahuastla); 2300 m.

[12] Stem < 5 cm high, sparsely branching; **Ros** 10 - 13 cm Ø; **L** linear-oblong, abruptly acuminate, acute, mostly convex on both faces, $4 - 6 \times 1.3 - 1.7$ cm, olive-green to red, turning bright red during cold dry conditions; **Inf** racemes 45 - 65 cm tall; **Ped** ascending-arching, 5 - 12 mm; **Sep** ascending to erect, oblong-ovate, 5 - 7 mm; **Cl** barrel-shaped, $7 - 10 \times 7$ mm Ø in the middle; **Pet** obtusely keeled, orange.

E. heterosepala Rose (Bull. New York Bot. Gard. 3(9): 8-9, 1903). **T**: Mexico, Puebla (Pringle 7499 [US]). – **D**: Mexico (Puebla: Esperanza, Cerro de

Paxtle; Oaxaca: Tlacotepec). **I**: Walther (1972). **Fig. XIII.d**

≡ *Pachyphytum heterosepalum* (Rose) E. Walther (1935); **incl.** *Pachyphytum chloranthum* E. Walther (1931); **incl.** *Echeveria viridiflora* Rose ms. ex von Poellnitz (1936) (*nom. inval.*, Art. 34.1c).

[2] Stem < 4 cm long, sparsely branching; **Ros** 4 - 6 cm Ø; **L** rhomboid-lanceolate, aristate-mucronate, $4 - 7 \times 1.5 - 2$ cm, grey-green; **Inf** a cincinnus, to 50 cm long or more; **Bra** easily detached; **Ped** 3 - 7 mm; **Sep** 5 - 7 mm, ascending to spreading; **Cl** broadly urceolate, ± 10 mm long, green in bud, later red; **Pet** with basal hollow within, often bearing an appendage on either side as in *Pachyphytum*. – *Cytology*: $n = 13$.

One of the few Echeverias growing in arid conditions on flat ground. It is difficult to maintain in cultivation.

E. humilis Rose (Bull. New York Bot. Gard. 3(9): 8, 1903). **T**: Mexico, San Luis Potosí (Parry & Palmer 233 p.p. [US]). – **D**: Mexico (Hidalgo, Querétaro, Guanajuato, San Luis Potosí). **I**: CSJA 39: 230, 1967. **Fig. XIII.c**

Incl. *Echeveria xichuensis* L. López & Reyes (1998).

[16] Stem short, eventually branching; **L** ovate-lanceolate, acute to acuminate, tip sharp to aristate, $4 - 5 (-7) \times \pm 2.2$ cm, very thick, thickest near base, lower face strongly convex, flattish above, usually brown, or more greenish in shade; **Inf** a cincinnus, simple or up to 3-branched, 20 cm long; **Ped** 2 - 4 mm; **Sep** ascending, to 9 mm, thick and turgid; **Cl** urceolate-campanulate, $\pm 13 \times 8$ mm Ø near base, yellowish below, salmon-orange above. – *Cytology*: $n = 32$.

Distinctive because of its very thick brownish leaves.

E. johnsonii E. Walther (CSJA 30(2): 46, ill., 1958). **T**: Ecuador (Johnson s.n. [CAS]). – **D**: Ecuador (near Guayllabamba). **I**: Walther (1972). **Fig. XIV.a**

[8] Stem to 20 cm long or more, ± 8 mm Ø, branching; **L** not rosulate but crowded along upper end of stems, clavate to linear-oblong, subterete, obtuse or acute, minutely apiculate, $\pm 3.5 \times 0.9$ cm Ø, green; **Inf** subspicate, ± 10 cm with 10 - 12 **Fl**; **Ped** ≤ 3 mm; **Sep** subequal, ascending to spreading; **Cl** strongly pentagonal, ± 11 mm long, yellowish with reddish tips and keels. – *Cytology*: $n = 22$.

A close relative of *E. quitensis*, distinguished by its nearly terete leaves.

E. juarezensis E. Walther (CSJA 31: 52, ill., 1959). **T**: Mexico, Oaxaca (MacDougall B.172 [CAS]). – **D**: Mexico (Oaxaca: Tuxtepec - Oaxaca highway near La Cumbre). **I**: Walther (1972).

[5] Stem to 10 cm long or more, 1.5 - 2 cm Ø, rarely branching; **Ros** 10 - 14 cm Ø; **L** rosulate, ob-

ovate-cuneate, acute, mucronate, deeply concave above, 5 - 8 × 3 - 5 cm, light green, somewhat glaucous; **Inf** to 20 cm, ± 12 mm Ø near base, usually with 3 cincinni 10 - 12 cm long, each with ± 12 **Fl**; **Ped** 5 - 14 mm; **Sep** ascending to widely spreading, to ± 11 mm; **Cl** conoid-urceolate, pentagonal, ± 12 × 8 mm Ø, scarlet. – *Cytology*: n = 27.

E. kimnachii J. Meyrán & Vega (Cact. Suc. Mex. 43(1): 6-9, ill. (incl. back cover), 1998). **T**: Mexico, Sinaloa (Vega 9206 [MEXU, ENCB, UAS]). – **D**: Mexico (Sinaloa: Sierra Tacuichamona).

[10] Stem nearly lacking; **Ros** usually solitary, ± 4.5 cm Ø, with 80 - 90 **L**; **L** oblanceolate, obtuse, mucronate, narrowed towards base, ± 2 × 0.8 - 1 cm, 4 - 6 mm thick, bluish-green, with a yellow mucro; **Inf** paniculate, 11 - 36 cm long, with 1 - 4 cincinni; **Ped** 4 - 6 mm, 1 mm Ø; **Sep** ascending to appressed against the **Cl**, nearly equal, 3.5 - 4.5 × 1.5 - 2.5 mm; **Cl** tubular-campanulate, 6 - 7 mm long, 4 mm Ø near the base, 7 mm Ø at the mouth; **Pet** oblanceolate, subacute, greenish to clear yellow.

A minute species allied to *E. amoena*, although the 2 are widely separated geographically.

E. laui Moran & J. Meyrán (Cact. Suc. Mex. 21: 57, 59-66, ill., 1976). **T**: Mexico, Oaxaca (*Lau* s.n. in Meyrán 4278 [MEXU 192469, ENCB, SD]). – **D**: Mexico (Oaxaca: in one of the lateral ravines of the Río Salado-Quiatepec). **I**: CBM 182: t. 774, 1979. **Fig. XIII.f**

[11] Stem usually 5 - 10 × ± 1.5 cm Ø, unbranched, covered below with persistent dry **L**; **Ros** 12 - 15 cm Ø; **L** obovate, broadly obtuse, minutely mucronate, 5 - 8.5 × 3 - 4.5 cm, 6 - 8 mm thick, upper face nearly flat to slightly concave, strongly white-glaucous or sometimes pinkish glaucous; **Inf** 6 - 10 cm long, with 5 - 7 conspicuous heavily glaucous **Bra**, cincinnus with 9 - 17 **Fl**; **Ped** 2 - 4 mm; **Sep** ascending, very unequal, 3 - 18 mm; **Cl** pentagonal-pyramidal, 13 - 16 mm long, red but heavily pruinose.

Perhaps the most beautiful of echeverias, unusual in the genus in growing at such a low altitude (500 m) and in a hot dry area. Slow-growing, it is otherwise of easy culture, providing water is kept from between the leaves. The leaves are easily marred when touched. Though not offsetting, the species can be propagated from leaves and bracts.

E. leucotricha Purpus (Monatsschr. Kakt.-kunde 24: 65, ill., 1914). **T**: Mexico, Puebla (*Purpus* s.n. [B †?]). – **D**: Mexico (Puebla: Cerro del Castillo, Caltepec). **I**: Walther (1972).

[4] Stem to 15 cm tall or more, 12 - 15 mm Ø, branching; **L** laxly subrosulate, oblong-oblancoate, obtuse, mucronate, 5 - 8 × 2 - 2.8 cm, 10 - 13 mm thick, green but densely covered with white **Ha**, with brown **Ha** at the tip; **Inf** subspicate to sub-

paniculate, to 40 cm; **Ped** short, mostly single-flowered; **Sep** appressed, to 10 mm; **Cl** to 18 × 8 mm Ø near the base, 7 mm Ø at the mouth, red. – *Cytology*: n = 38.

Distinguished from *E. pulvinata* by its thicker, narrower, more oblong leaves and different chromosome number.

E. lilacina Kimnach & Moran (CSJA 52(4): 175-179, ill., 1980). **T**: Mexico, Nuevo León (*Kimnach & Lyons* 1421 [HNT]). – **D**: Mexico (Nuevo León: near Rayones). **Fig. XIII.e**

[16] Stem < 5 cm long, ± 1.5 cm Ø, not branching; **Ros** 11 - 17 cm Ø; **L** densely rosulate, obovate-spatulate, obtuse, mucronate, 5 - 6 × 2.5 - 3.7 cm at the widest point, 1 - 1.2 cm wide near base, with hyaline margin, brownish-olive-green but hidden by light violet-white to pinkish-white waxy powder; **Inf** with 1 (-2) cincinni, with recurving tip when young, later erect, 28 - 36 cm tall up to first **Fl**, 3 - 5 mm Ø; **Bra** 14 - 26, 8 - 18 × 4 - 6 mm; raceme single, 10 - 24 cm with 10 - 18 **Fl**; **Ped** pendent, erect in **Fr**, 9 - 27 mm, ± 1 mm Ø, pink; **Sep** appressed except for expanding tips, 1.5 - 7 × 1 - 4 mm; **Cl** urceolate, 6 - 7.5 mm Ø; **Pet** triangular-lanceolate, acute, 13 - 14 × ± 4 mm, coral-pink, tips abruptly rotate-recurving. – *Cytology*: n = 27.

One of the most decorative and popular echeverias because of its compact symmetry and distinctive light lilac colour.

E. longiflora E. Walther (CSJA 31: 101, ill., 1959). **T**: CAS. – **D**: Mexico (based on a cultivated plant said to have come from Guerrero). **I**: Walther (1972).

[5] Stem of unknown height, stout, usually unbranched; **L** obovate-orbicular, obtuse, acutish or apiculate, narrowing at the base into a narrow channelled petiole, ± 15 × > 8 cm, green, tinged light violet, ± glaucous; **Inf** cymose-paniculate, 3-branched, to 75 cm tall; **Ped** to 15 mm; **Sep** ± 12 mm, widely spreading to slightly recurved; **Cl** long and relatively narrow, to 22 × 13 mm Ø near the base, 10 mm Ø at the mouth, purplish below, rose above, glaucous. – *Cytology*: n = 27.

Distinct in the *E. gibbiflora* alliance because of its long narrow corolla lacking a yellow or orange coloration. Similar flowers are found in *E. scheeri*, which otherwise seems distinct.

E. longissima E. Walther (CSJA 9: 147, ill., 1938). **T**: Mexico, Puebla (*Purpus* 3953 [NY, UC]). – **D**: Mexico (Oaxaca, Puebla).

E. longissima var. *aztatlensis* J. Meyrán (Cact. Suc. Mex. 27(2): 33-36, ill., 1982). **T**: Mexico, Oaxaca (*Otero* 25 in Meyrán 4318 [MEXU 025616]). – **D**: Mexico (Oaxaca: near San Miguel Aztatla). **Fig. XII.e**

[6] Differs from var. *longissima*: Caespitose; **L** ±

3 × 1.5 cm, **Inf** 1- to 2- (to 3-) flowered; **Cl** broadly urceolate, to 12 mm Ø; **St** to 35 mm.

More easily grown and propagated than the type variety. After anthesis its flowers expand and change form, resembling Chinese lanterns.

E. longissima var. **longissima** – **D**: Mexico (Oaxaca: Paraje San Bartolo, N of Concepción de Buenavista; Puebla). **Fig. XII.h**

Incl. *Echeveria harmsii* var. *multiflora* E. Walther (1935).

[6] Stem < 5 cm long, ± 1.5 cm Ø, almost always unbranched; **Ros** flat, 6 - 7 cm Ø; **L** broadly obovate-cuneate, cuspidate, 6 × 3 cm, dark green, glabrous, often red-margined; **Inf** to 30 cm tall, with 1 - 3 cincinni; **Bra** conspicuous, nearly overlapping; **Fl** 4 - 12; **Ped** 10 - 17 mm, without bracteoles; **Sep** ascending to widely spreading, ovate-deltoid to oblong-lanceolate, to 8 mm; **Cl** narrowly urceolate-cylindrical, to > 30 mm long, 10 mm Ø near base; **Pet** narrowly oblong, weakly keeled, green near tips, otherwise orange; **St** to 25 mm. – *Cytology*: n = 42.

A particularly choice species, notable for its compact rosettes of green, red-edged leaves and the largest flowers in the genus. Unfortunately, it is slow and difficult to grow or propagate. It has recently been rediscovered by F. Otero.

E. lozanoi Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 23, 1905). **T**: Mexico, Jalisco (*Pringle & Lozano* 11890 [US]). – **D**: Mexico (Jalisco). **I**: CSJA 39: 230, 1967, identity uncertain.

[5] Stem to 5 cm long; **Ros** lying flat on the ground, ± 20 cm Ø; **L** oblong-lanceolate or strap-shaped, acute, 10 - 15 × 2 - 4 cm, flattened and rather thickish, the base thicker and somewhat channelled, central **L** copper-colored; **Inf** 30 - 45 cm tall, with a short paniced cyme with 3 - 7 **Br** of 2 - 4 **Fl**; **Ped** to 10 mm, stout; **Sep** unequal, ovate, acute, the longest to 11 mm; **Cl** 10 - 15 mm long, copper-coloured.

A rare species, unknown in cultivation. Several attempts have been made to re-collect it at the type locality, where it seems to have been destroyed by goats. The species name was originally misspelled 'lozani'.

E. lutea Rose (J. Washington Acad. Sci. 1: 268, ill., 1911). **T**: Mexico, San Luis Potosí (*Purpus* 800 [US]). – **D**: Mexico (San Luis Potosí). **I**: Walther (1972). **Fig. XII.f**

Incl. *Echeveria lutea* var. *fuscata* E. Walther (1972).

[1] **R** thickened; stem < 5 cm long, 1 - 2 cm Ø, sparsely branching; **Ros** 8 - 12 cm Ø; **L** densely rosulate, linear-elliptic to oblanceolate, long-acuminate, tip acute, upcurving, deeply channelled above, 4 - 15 × 0.8 - 1.8 cm, 3 - 7 mm thick, green to brownish-green; **Inf** with 1 or 2 cincinni, to 28 - 75 cm

tall, apical portion strongly deflected before anthesis; **Bra** conspicuous, elliptic-linear, semiterete, 25 - 65 mm; **Ped** to 2 mm long, 2 - 4 mm Ø; **Sep** widely spreading to somewhat reflexed; **Cl** strongly pentagonal, 12 - 17 × 8 - 12 mm Ø near the base, 3 - 5 mm Ø at the mouth, yellow. – *Cytology*: n = 12.

An attractive species with lovely yellow flowers. It is rather difficult to maintain, being native to hot arid areas.

E. macdougallii E. Walther (CSJA 30(3): 87, ill., 1958). **T**: Mexico, Oaxaca (*MacDougall* B.15 [CAS]). – **D**: Mexico (Oaxaca). **I**: Walther (1972).

Incl. *Echeveria sedoides* E. Walther (1958).

[8] Stem much-branched, to 20 cm tall or more; **Ros** 4 - 5 cm Ø; **L** diffusely rosulate or scattered, oblong-obovate to obovate, cuneate, thick-clavate, upper face somewhat flattened, obtuse or minutely mucronate, 2 - 3 × ± 1 cm, 5 - 6 mm thick near tip, green, tinged reddish towards tip; **Inf** racemes ± 10 cm long; **Ped** 5 - 20 mm; **Sep** ascending to reflexed, ± 10 mm; **Cl** 15 - 18 × 8 - 12 mm Ø near base, reddish-yellow. – *Cytology*: n = 19, 34, 40, 42, 50.

E. macrantha Standley & Steyermark (Publ. Field Mus. Nat. Hist., Bot. ser. 23(4): 159, 1944). **T**: Guatemala, Jalapa (*Steyermark* 32808 [F]). – **D**: Guatemala (Jalapa).

[4] Stem shrubby, sparsely branched; **L** densely rosulate, rounded-cuneate, 3 × 2 - 2.8 cm, obtuse or subtruncate, very shortly spiculate, cuneate at the base, with abundant but not very dense minute **Ha** on both surfaces, pale yellowish-green, margins rose-coloured; **Inf** stout, 45 cm, ± 3-flowered; **Ped** 8 mm, thick, hirsute; **Sep** almost free, 8 mm, with minute dense **Ha**; **Cl** 2 cm long, colour unknown, outside hairy.

An uncertain species in need of re-collection and study. The description was apparently made from a herbarium specimen, of which the inflorescence may have been incomplete. The authors stated that Walther considered it synonymous with *E. pringlei*.

E. maxonii Rose (CUSNH 12(9): 395-396, t. 48, 1909). **T**: Guatemala (*Maxon* 3406 [US 473390]). – **D**: Guatemala, Honduras. **I**: Walther (1972).

[8] Stem to 80 cm long, sparsely branching; **L** subrosulate, oblanceolate to spatulate, obtuse and mucronate or acute, deeply concave above, 3 - 10 × ± 3 cm, minutely papillose, green; **Inf** a raceme or subpaniculate below, to 60 cm tall, **Fl** in groups of 2 - 3 below, single above; **Ped** 8 - 10 mm; **Sep** ascending to spreading, to 5 mm; **Cl** 10 × 6 mm Ø near the base, scarlet. – *Cytology*: n = 26.

E. megacalyx E. Walther (CSJA 31: 50-51, ill., 1959). **T**: Mexico, Oaxaca (*MacDougall* B.187 [CAS?]). – **D**: Mexico (Oaxaca). **Fig. XIV.b**

[12] Stem sparsely branching, < 5 cm long, 1.5 - 2 cm Ø; **Ros** 6 - 9 cm Ø; **L** oblong-spatulate, muc-

ronate, margins translucent and dentate-lacerate, 3 - 10 × 2 - 3 cm, green to slightly bluish-glaucous; **Inf** racemes to 45 cm, ± 8 mm Ø near base; **Ped** of lower **Fl** 3 - 8 mm, of upper **Fl** very short; **Sep** somewhat spreading, large and L-like, obovate-elliptic, acute, 8 - 10 × ± 6 mm; **Cl** urceolate, ± 8 × 5 - 8 mm Ø near tip, dull green-yellow. – *Cytology*: n = 20.

A difficult-to-grow species, highly attractive to mealy-bugs.

E. minima J. Meyrán (Cact. Suc. Mex. 13: 47-50, 62, [64], ill., 1968). **T**: Mexico, Hidalgo (*Otero* s.n. [UNAM]). – **D**: Mexico (Hidalgo: Puente de Tasquillo). **Fig. XIV.c**

[13] Stem usually < 3 cm high, branching; **Ros** 3.5 - 4 cm Ø; **L** densely rosulate, obovate, prominently mucronate, 0.8 - 2 × 0.5 - 0.9 cm, 2 - 4 mm Ø, glaucous green, margin and mucro reddened; **Inf** 1 - 4 per **Ros**, 1.2 - 3.5 cm long up to the first **Fl**, cincinni 3- to 7- (to 9-) flowered; **Ped** 3 - 6 mm; **Sep** expanding; **Cl** 8.5 - 11 × 5 - 7 mm Ø near base, rose near base, yellow above. – *Cytology*: n = 28.

A tiny species well-suited for small pots or dish-gardens.

E. montana Rose (Bull. New York Bot. Gard. 3(9): 6, 1903). **T**: Mexico, Oaxaca (*Pringle* 4706 [US, ENCB]). – **D**: Mexico (Chiapas, Oaxaca), Guatemala. **I**: Walther (1972).

≡ *Echeveria nuda* var. *montana* (Rose) von Poellnitz (1936).

[8] Plants shrubby, branching; stem to 50 cm tall, ± 13 mm Ø; **L** subrosulate, obovate, obtuse, mucronate, to 7 × 4 cm, thin, nearly flat above, smooth, green; **Inf** spicate, to 60 cm; **Fl** 10 - 20, shorter than the upper **Bra**; **Ped** < 4 mm; **Sep** ascending, to 12 mm; **Cl** broadly urceolate, ± 13 × 10 mm Ø near the base; **Pet** scarcely spreading at the tips, reddish, margins yellow. – *Cytology*: n = 22.

E. moranii E. Walther (Echeveria, 347, ill., 1972). **T**: Mexico, Oaxaca (*Moran* 6388 [SD]). – **D**: Mexico (Oaxaca: N of Totolapan). **Fig. XIV.d**

Incl. *Echeveria proxima* E. Walther (1972).

[12] Stem < 6 cm long, ± 8 mm Ø, usually unbranched; **Ros** 4 - 5 cm Ø; **L** obovate-cuneate, mucronate, 3 - 6 × 1.5 - 3 cm, 5 - 9 mm thick, grey-green, red-margined, with a reddish keel on the lower face and with scattered red dots; **Inf** subhorizontal, racemose with **Fl** pendent along the lower side, 15 - 30 cm long; **Ped** ± 1 cm, 1 mm Ø; **Sep** appressed, nearly equal; **Cl** bluntly pentagonal, ± 13 mm long, red to scarlet. – *Cytology*: n = 24.

Distinct by its nearly horizontal inflorescence and pendent flowers.

E. mucronata Schlechtendal (Linnaea 13: 411, 1839). **T**: Mexico, Hidalgo (*Anonymus* s.n. [neo - icono: Schlechtendal, Hort. Hal., t. 10, 1853]). – **D**:

Mexico (Hidalgo, Michoacán, Morelia, Tlaxcala, México, Puebla, Distrito Federal, Veracruz, Tamaulipas, Guanajuato). **I**: Walther (1972).

≡ *Cotyledon mucronata* (Schlechtendal) Baker (1869) (*nom. illeg.*, Art. 53.1); **incl.** *Echeveria crassicaulis* E. Walther (1935).

[7] **R** fusiform-thickened, rarely branching; stem nearly lacking; **L** semideciduous, narrowly rhomboid-oblongate, acute, mucronate, upper side flat, 7 - 9 × to 2.5 cm, green, slightly glaucous, often spotted reddish-brown; **Inf** spicate, to 50 cm, with ≥ 15 **Fl**; **Ped** usually very short and thick, 1 - 4 mm long; **Sep** somewhat spreading, to 9 mm, mucronate; **Cl** urceolate-conoid, 12 - 16 × 10 mm Ø near the base, 5 mm Ø near the mouth, amber to light yellow. – *Cytology*: n = 16, 32.

Collections reported from Chihuahua, Durango and Zacatecas have smaller flowers and may prove to be a different species.

E. multicaulis Rose (CUSNH 8: 294, 1905). **T**: Mexico, Guerrero (*Nelson & Goldman* 628 [US]). – **D**: Mexico (Guerrero: near Chilpancingo). **I**: Walther (1972).

[8] Stem much-branched from the base, 25 to > 100 cm long, granular-roughened; **Ros** ± 7 - 9 cm Ø; **L** subrosulate, obovate-cuneate, obtuse to truncate, mucronate, 3 - 4 × 1.5 - 3 cm, dark green, shiny, with red margins and tip; **Inf** racemes, spikes or thyrses, to 25 cm, 6- to 15-flowered, granular-roughened; **Ped** ± 1 cm, the upper ones shorter; **Sep** ascending, to 6 mm; **Cl** campanulate, pentagonal, ± 10 mm long or more, 5 mm Ø near the base, 10 mm Ø at the mouth, carmine to scarlet. – *Cytology*: n = 21.

E. nayaritensis Kimnach (CSJA 51(5): 207-209, ill., 1979). **T**: Mexico, Nayarit (*Kinnach* 1912 [HNT]). – **D**: Mexico (Nayarit: near lake NE of Santa María del Oro).

[5] Stem to 14 cm tall, 2 - 3 cm Ø, rarely branching; **Ros** diffuse; **L** obovate, subobtusate, mucronate, larger on younger plants, 4 - 16 × 2 - 7 cm, purplish when young, later purplish-brown; **Inf** cymose-paniculate, 35 - 75 cm long, 2- to 10-branched, each **Br** with 1 - 3 cincinni; **Ped** 7 - 11 mm; **Fl** 5 - 10 on each raceme; **Sep** recurving-reflexed, deltoid-ovate, acute, 3 - 8 mm, reddish-green; **Cl** campanulate, 9 - 10 mm Ø; **Pet** oblong-ovate, acute, recurving apically, 12 - 15 × 5 - 6 mm at the middle, exterior pinkish-cream on basal 1/3, apical 2/3 orange, strongly keeled, reddish. – *Cytology*: n = 27.

Distinguished in the *Gibbiflorae* by its tall stem.

E. nodulosa (Baker) Otto (Hamburg. Gart.- & Blumenzeit. 29: 8, 1873). **T**: [lecto - icono]: Refug. Bot. 1: t. 56, 1869. – **D**: Mexico (widely distributed and rather common in N Oaxaca and S Puebla). **I**: Walther (1972). **Fig. XIII.g**

≡ *Cotyledon nodulosa* Baker (1869); **incl.** *Eche-*

veria discolor De Smet (1874); **incl.** *Echeveria misteca* De Smet ex Morren (1874) (*nom. inval.*, Art. 32.1c?); **incl.** *Echeveria sturmiana* von Poellnitz (1938); **incl.** *Echeveria nodulosa* var. *minor* E. Walther (1972).

[8] Stem to 20 cm long, much-branched, irregularly angular; **L**, **Bra**, **Sep** and outside of **Pet** minutely papillose; **L** subrosulate to scattered, obovate-cuneate, acute, to $5 \times \pm 1.5$ cm, $\pm$ heavily marked with purplish-red on both faces and along margins, rarely entirely green; **Inf** racemose, to 30 cm; **Ped** to 5 mm; **Sep** widely spreading, rarely reflexed, up-curving at tips; **Cl** sharply pentagonal, ± 16 mm long; **Pet** rose, yellowish along margins and at tips. – *Cytology*: $n = 16$.

One of the few echeverias with marked leaves. A clone with esp. beautiful markings has been distributed as *E. nodulosa* 'Painted Beauty', originally collected in Oaxaca along the road from Teotitlán del Camino to Huautla de Jiménez (ISI 1137).

E. nuda Lindley (Gard. Chron. 1856: 280, 1856). **T**: [neo – icono]: Refug. Bot. 1: t. 57, 1869. – **D**: Mexico (Puebla, Veracruz: a "30 mile-wide area between Orizaba, Esperanza and Tehuacán" [R. Moran]). **I**: Walther (1972).

≡ *Cotyledon nuda* (Lindley) Baker (1869).

[8] Plants glabrous, to 50 cm tall or more, stem 6 - 10 mm Ø, branching; **Ros** 5 - 9 cm Ø; **L** semirosulate, obovate, cuneate, obtuse, mucronate, 2.5 - 5 × 1.8 - 3 cm, 3 - 4 mm thick, dull green, at first slightly glaucous, sometimes with a purplish margin; **Inf** racemes, 15 - 45 cm; **Ped** nearly horizontal, 2 - 3 mm; **Sep** widely spreading, 6 - 12 mm; **Cl** 10 - 12 × 7 - 9 mm Ø at the base, the lower part red, yellow above. – *Cytology*: $n = 24$.

E. olivacea Moran (Cact. Suc. Mex. 36(3): 51-55, ill., 1991). **T**: Mexico, Oaxaca (*MacDougall* s.n. [SD 129113]). – **D**: Mexico (Oaxaca: Tehuantepec).

[12] Stem < 3 cm long, ± 1 cm Ø; **Ros** 9 - 10 cm Ø; **L** ± 12 , elliptic, acute to obtuse, apiculate, 4 - 6 × 1.5 - 3 cm, ± 4 mm thick, surface and margin with thin short papillae, olive-green; **Inf** racemes, 20 - 50 cm overall, raceme 20 - 25 cm; lower **Bra** prominent, 4 - 6 cm, upper **Bra** abruptly becoming smaller; **Ped** ascending, 6 - 14 mm; **Sep** ascending, appressed, unequal; **Cl** 10 - 12 mm long, watermelon-red, somewhat glaucous.

E. oreophila Kimnach (Haseltonia 9: [in press], ill., 2002). **T**: Peru, Cajamarca (*Bauer & Kimnach* 10 [SM]). – **D**: Peru (Cajamarca).

[12] **Br** 10 cm tall or more, 15 - 26 mm Ø; **Ros** rarely branching, 11 - 15 cm Ø; **L** 20 - 30, widely obovate, nearly truncate, mucronate, 5 - 7 × 3.5 - 4.5 cm, basally 1 - 1.5 cm wide, 2 - 4 mm thick, pale green, slightly glaucous, often reddened; **Inf** equilaterally racemose, 12 - 20 cm tall; **Ped** ascending, 2 -

4 mm; **Sep** erect to somewhat expanding, 4 - 6 mm; **Cl** 12 - 14 mm, uniformly rose-red.

Differs from *E. wurdackii* in its more succulent leaves, short pedicels and red flowers.

E. pallida E. Walther (CSJA 10: 14, ill., 1938). **T**: CAS. – **D**: Mexico. **I**: Walther (1972).

[5] Stem branching, to 10 cm long or more, ± 1.5 cm Ø; **Ros** 15 - 20 cm Ø; **L** obovate-spatulate, > 15 × 9 cm, obtuse, mucronate, light green; **Inf** to 50 cm, cymose-paniculate, with 8 or more cincinni, these sometimes 2-branched; **Ped** < 6 mm; **Sep** very unequal, to 14 mm; **Cl** 16 × 12 mm Ø near the base, scarlet to pink. – *Cytology*: $n = 54$.

This plant is evidently not a hybrid, but a native locality has not yet been recorded.

E. paniculata A. Gray (Pl. Wright. 1: 76, 1852). **T**: Mexico, Chihuahua (*Wislizenus* 170 [GH]). – **D**: Mexico.

E. paniculata var. **maculata** (Rose) Kimnach (Haseltonia 5: 51, 1998). **T**: Mexico, Hidalgo (*Rose & Hay* 217 (6412) [US]). – **D**: Mexico (Hidalgo, Querétaro, Michoacán, San Luis Potosí, Zacatecas, Jalisco); widespread on $\pm$ level terrain. **I**: Walther (1972: as *E. maculata*).

≡ *Echeveria maculata* Rose (1903); **incl.** *Echeveria longipes* E. Walther (1935).

[15] Differs from var. *paniculata*: **L** narrowly rhomboid-oblongate, 7 - 10 × 1.5 - 2.5 cm, rather thick and more succulent; **Inf** thyrses, either subpaniculate below and spicate-racemose above or with numerous, mostly 2-flowered branchlets; **Ped** 1 - 2 (-16) mm; **Sep** widely expanding, to 8 mm; **Cl** $\pm 16 \times 9$ mm Ø near the base, yellow. – *Cytology*: $n = 28$.

E. paniculata var. **paniculata** – **D**: Mexico (Chihuahua, Durango, Zacatecas). **I**: Walther (1972).

Incl. *Cotyledon greyi* Baker (1869) ≡ *Echeveria greyi* (Baker) Morren (1874) (*nom. illeg.*, Art. 52.1).

[15] **R** fusiform, fleshy; stem nearly lacking, rarely branching; **Ros** ± 10 - 12 cm Ø; **L** spreading horizontally, oblanceolate, acuminate, $\pm 10 \times 3$ cm, rather thin, green; **Inf** cymose-paniculate, **Br** 6 - 8, each with 1 - 6 **Fl**; **Ped** short; **Sep** more ascending than in var. *maculata*, to 10 mm; **Cl** $\pm 12 \times 9$ mm Ø near the base, reddish-yellow near the base, yellow above. – *Cytology*: $n = 28$.

E. papillosa Kimnach & C. H. Uhl (CSJA 55(1): 27-30, ill., 1983). **T**: Guatemala, Totonicapán (*Uhl* 2589 [HNT, BH, F, US]). – **D**: Guatemala (Totonicapán).

[12] Stem < 10 cm tall, 8 - 12 mm Ø, branching; **Ros** proliferous, 5 - 10 cm Ø, with 15 - 25 **L**; **L** obovate-oblongate, subobtuse, mucronate, 2.5 - 3.5 × 1 - 1.6 cm, keeled underneath towards tip, green,

somewhat reddened along margins, papillose, the papillae semiglobose on **L**-faces and forming obtuse cilia along margins; **Inf** papillose, equilaterally racemose, 10 - 12 cm, flowering portion at first densely subcapitate, later 4 - 9 cm long, 2- to 6-branched; **Sep** ascending, ovate-elliptic, acute, 5 - 8 × 2 - 3 mm; **Cl** campanulate-globose, 8 - 10 × 6 - 8 mm Ø; **Pet** ovate-elliptic, acute, 2.5 - 3.5 mm wide, outside reddish-orange, papillose. – *Cytology*: n = 15.

A species without close allies.

E. peacockii Croucher (Gard. Chron., ser. nov. 1: 674, 1874). **T**: [neo – icono]: Van Laren, Succulents, fig. 107, 1934. – **D**: Mexico (Puebla). **I**: Walther (1972). **Fig. XV.d**

≡ *Cotyledon peacockii* (Croucher) Baker (1874); **incl.** *Echeveria desmetiana* Morren (1874) ≡ *Cotyledon desmetiana* (Morren) Hemsley (1880); **incl.** *Echeveria subsessilis* Rose (1905).

[11] Stem < 10 cm long, 10 - 15 mm Ø, rarely branching; **Ros** 5 - 10 cm Ø; **L** 24 - 50, densely rosulate, oblong-ovate to oblong-obovate, abruptly acuminate, cuspidate, 2 - 5 × 1 - 2.5 (-3.5) cm, bluish-white, red-margined; **Inf** with 1 - 4 cincinni, to 15 cm tall; **Ped** ± 2 mm long and thick; **Sep** very unequal, ± 10 × 5 mm; **Cl** strongly pentagonal, 11 × 8 mm Ø near the base, glaucous pink. – *Cytology*: n = 15.

Introduced by B. Roezl as early as 1874 but without a recorded locality. Typical of white-leaved echeverias, this grows in hot dry areas, though generally in shade.

E. penduliflora E. Walther (CSJA 30(5): 151, ill., 1958). **T**: Mexico, Oaxaca (*MacDougall* B.174 [CAS]). – **D**: Mexico (Oaxaca); ± 1200 m. **I**: Walther (1972).

[12] Plants shrubby, to 30 cm tall, glabrous; **L** scattered to subrosulate, oblong-oblancheolate, mucronate, to 14 × 4 cm, green; **Inf** racemes to 30 cm; **Ped** horizontal towards base, downcurving above so that **Fl** are somewhat pendent; **Sep** ascending, to 6 mm; **Cl** bluntly pentagonal, 13 × 9 mm Ø near the base, pink to red. – *Cytology*: n = 22.

E. pendulosa Kimnach & C. H. Uhl (CSJA 64(4): 200-203, ill., 1992). **T**: Venezuela, Mérida (*Uhl* 2749 [BH, HNT, US]). – **D**: Venezuela (Mérida: ± 30 km W of Mérida).

[8] Stem much-branched, erect when young, later pendulous, to 2 m long or more, 3 - 5 mm Ø, forming profuse aerial **R**; **L** present only near stem tips, 0.5 - 2.5 cm apart, obovate-oblong, subobtusate, (1-) 1.5 - 2.5 × 1 - 1.5 (-2) cm, bluish-green, glaucous, margins reddish; **Inf** racemes, ascending on erect stems, ± horizontal on pendent stems, 13 - 23 cm long; **Ped** strongly decurved, 4 - 19 mm; **Sep** ovate-cuneate, acute, 4 - 6 × 2.5 - 3 mm, appressed to **Pet** below, expanding apically; **Cl** cylindrical to

campanulate, 10 - 13 × 8 - 9 mm Ø, yellowish-peach on the basal ½, pinkish-yellow towards tip. – *Cytology*: n = 42.

Differs from *E. bicolor* in its pendulous stems, erect sepals and in having 42 chromosomes.

E. peruviana Meyen (Reise um die Erde 1: 448, in adnot., 1834). **T**: Peru, Tacna (*Meyen* s.n. [F [lecto: photo]]). – **D**: Peru (known certainly only from the type locality).

≡ *Cotyledon peruviana* (Meyen) Baker (1869).

[12] **L** basal, obovate-cuneate, acute, fleshy; **Inf** bracteate, **Bra** lanceolate, acute; **Sep** much shorter than **Cl**, obovate, acute, glabrous; **Pet** purple. – *Cytology*: n = ± 50.

The above description is all that is certainly known about this species, which has never been re-collected at the type locality. *Hutchison* 7176 (UC), from 62 km NE of Tacna, from the same approximate area, has oblong green leaves with red edges, red petals and ± 50 chromosomes. Walther's (1972) description was based on a plant from Argentina, where plants resembling *E. peruviana* are sometimes glaucous and sometimes green, with yellow, orange or red flowers. Other similar plants from C Peru have ovate to lanceolate green leaves. Clearly, field-work is needed to classify all these populations.

E. pilosa J. A. Purpus (Monatsschr. Kakt.-kunde 27: 146-148, ill., 1917). **T**: [lecto – icono]: l.c. fig. p. 147. – **D**: Mexico (Puebla: Sierra de Mixteca, near San Luis Atolotitlán). **I**: Walther (1972).

[3] Plants hirsute except inside of **Fl**; stem to ± 8 cm tall, rarely branching; **Ros** ± 14 cm Ø; **L** laxly rosulate, oblanceolate, shortly acuminate, to 7 × 2 cm, upper face concave, green; **Inf** 2 or more, cymose-paniculate, to 30 cm, with 5 or more **Br**, each 1- to 5-flowered; **Ped** of lower **Fl** short, those of upper **Fl** to 16 mm; **Sep** ascending to spreading, to 15 mm; **Cl** sharply pentagonal, to 12 × 10 mm Ø near the base, 6 mm Ø at the mouth, keel scarlet, sides orange, tip yellow. – *Cytology*: n = 24.

Distinguished from *E. coccinea* by its short stem and paniculate inflorescence.

E. pinetorum Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 20, 1905). **T**: Mexico, Chiapas (*Goldman* s.n. [US]). – **D**: Mexico (Chiapas, Oaxaca), Guatemala. **I**: Walther (1972).

≡ *Echeveria sessiliflora* var. *pinetorum* (Rose) von Poellnitz (1936); **incl.** *Echeveria huehueteca* Standley & Steyermark (1944).

[7] **R** fleshy, fusiform; stem nearly lacking, branching; **L** often deciduous during the dry season, narrowly oblanceolate, acute to acuminate, 2 - 4 × 1 - 1.5 cm, greenish-yellow; **Inf** spicate, to 30 cm; **Sep** to 3 mm; **Cl** 8 - 10 × 6 mm Ø near the base, 4 mm Ø at the mouth, scarlet at the base, yellowish above. – *Cytology*: n = 14.

A difficult species to maintain in cultivation. It is closely allied with *E. sessiliflora*, which differs in its non-tuberous roots and bluish leaves.

E. pittieri Rose (CUSNH 13(9): 296, 1911). **T:** Guatemala (*Pittier* 1880 [US 618381]). – **D:** Guatemala (Jutinapa, Totonicapan, Quetaltenango), Nicaragua (Jinotega), Costa Rica (W coast); epiphytic or on rocks in shaded forests. **I:** Walther (1972).

[14] Stem to 10 cm tall or more, branching; **L** laxly rosulate, elliptic-oblongate, acute, 4 - 6 (-10) × 2 cm, green, often brownish-tinged; **Inf** to 20 cm, flowering portion an equilateral spike, densely-flowered, 3 - 4 cm long, with ± 20 **Fl**; **Ped** to 1 mm, the lowest ones sometimes 2-flowered; **Sep** somewhat spreading to ascending; **Cl** campanulate, sharply pentagonal, 12 - 13 × 6 mm Ø at the base, to 11 mm Ø at the mouth, red. – *Cytology*: n = 62.

E. platyphylla Rose (Bull. New York Bot. Gard. 3(9): 7, 1903). **T:** Mexico, Distrito Federal (*Rose & Hay* 202 [US]). – **D:** Mexico (México, Hidalgo, Distrito Federal). **I:** Walther (1972).

[15] **R** thickened, fusiform; stem nearly lacking, rarely branching; **Ros** ± 10 cm Ø; **L** often lacking in the dry season, horizontally spreading, obovate-rhomboid, acuminate, cuspidate, ± 5.5 × 2.5 cm, grey-green; **Inf** spicate, to 40 cm, with ± 15 crowded **Fl**; **Ped** mostly single-flowered, < 2 mm; **Sep** erect to slightly spreading; **Cl** to 14 × 9 mm Ø at the base, yellow, slightly reddish when older. – *Cytology*: n = 28.

Differs from *E. paniculata* in its smaller grey-green leaves and more spicate inflorescence with more crowded flowers.

E. pringlei (S. Watson) Rose (Bull. New York Bot. Gard. 3(9): 6, 1903). **T:** Mexico, Jalisco (*Pringle* 1853 [GH]). – **D:** Mexico (Jalisco, Durango).
= *Cotyledon pringlei* S. Watson (1890).

E. macrantha (which see) may be a synonym or at least a relative. *E. pringlei* is a variable species best divided into 3 varieties:

E. pringlei var. **longisepala** Kimnach (Haseltonia 5: 51, 1998). **T:** Mexico, Jalisco (*Bauml & Voss* 1932 [HNT]). – **D:** Mexico (Jalisco: E of mesa of San Andrés Cohamiata), 1800 m.

[4] Stem to 80 cm long or more, ± 1 cm Ø; **L** spaced 0.5 - 1 cm apart, obovate to oblanceolate, mucronate, 3 - 4 × 1.5 - 2 cm, 3 - 4 mm thick, glabrous, green; **Inf** to 50 cm, 5- to 6-flowered; **Ped** 6 - 10 mm; **Sep** widely expanding, to 18 mm; **Cl** 18 mm long, orange-red.

Distinct because of its tall robust stems, larger glabrous leaves and long sepals.

E. pringlei var. **parva** Kimnach (Haseltonia 5: 52, 1998). **T:** Mexico, Durango (*Spencer* s.n. [HNT]). – **D:** Durango (Tayaltita).

[4] Stem to 40 cm high or more, 3 - 5 mm Ø, much-branched, tan; **L** obovate, cuspidate, both faces convex, ± 1.5 × 0.8 cm, 5 - 6 mm thick near tip, glabrous, green, margin near tip heavily reddened, very minutely papillose; **Inf** to 20 cm, with 5 **Fl** or more; **Ped** 4 - 6 × ± 2 mm Ø; **Sep** ascending, lanceolate, acute, 6 - 8 mm; **Cl** 12 - 14 × ± 8 mm Ø, light orange.

Distinguished from the other varieties by its small glabrous reddened leaves.

E. pringlei var. **pringlei** – **D:** Mexico (Jalisco: barrancas near Guadalajara). **I:** Walther (1972).

[4] Plants shrubby, densely but minutely pubescent except inside **Fl**; stem to 20 - 30 cm long or more, ± 6 mm Ø; **L** subrosulate at stem tips, oblanceolate to rhomboid-obovate, acute-mucronate, 2 - 3 (-4) × 1 - 1.5 (-2) cm, ± 5 mm thick, light green, often reddish along margins near tip; **Inf** racemose; **Ped** 4 - 8 mm; **Sep** ascending to spreading, to 14 mm, green; **Cl** urceolate, sharply pentagonal, to 15 mm long, orange-red to scarlet. – *Cytology*: n = 23.

E. procera Moran (CSJA 39(5): 182-185, ill., 1967). **T:** Mexico, Oaxaca (*MacDougall* B.85 [SD]). – **D:** Mexico (Oaxaca).

[8] Plants glabrous; stem to 2 m tall, 3 - 4 cm Ø, branching; **Ros** 15 - 30 cm Ø; **L** oblong-obovate, obtuse to slightly retuse, apiculate, 7 - 10 × 4 - 6 cm, upper face channelled, green; **Inf** subsapicate, to 1.5 m or more; **Bra** horizontal to deflexed, conspicuous, to 3 cm; **Ped** 0.5 - 2 mm × 2 - 3 mm Ø; **Sep** wide-spreading; **Cl** 11 - 12 × 7 - 8 mm Ø near the base, 5 - 7 mm Ø at the mouth, red; **Pet** with an appendage on each side of the **Nec**. – *Cytology*: n = 22.

Scales at the base of the petals are also found in *E. heterosepala* and *E. dactylifera*, though these 3 species are not closely related.

E. prolifica Moran & J. Meyrán (CSJA 50(6): 289-291, ill., 1978). **T:** Mexico, Hidalgo (*Meyrán* 3462 [MEXU, ENCB, SD]). – **D:** Mexico (Puebla). **Fig. XIII.h**

[10] Stem < 3 cm long, 4 - 7 mm Ø, proliferous by stolons; **Ros** 4 - 8 cm Ø; **L** obovate-cuneate, obtuse, cuspidate, 2 - 4 × 1 - 1.6 cm, 4 - 8 mm thick, convex on both faces, light glaucous-green; **Inf** sprawling-decumbent, cymose, 15 - 25 cm long; **Bra** easily detached and rooting to form new plants, the cyme dense, 2 - 3 cm wide, with 2 - 5 cincinni, each with up to 4 **Fl**; **Ped** ± 1 mm; **Cal** cup-shaped; **Sep** upcurved; **Cl** campanulate, 5 - 6 mm long, yellow. – *Cytology*: n = 33.

The stout campanulate flowers are unique in the genus. As with its ally, *E. amoena*, it will easily spread because of its deciduous bracts.

E. prunina Kimnach & Moran (CSJA 53(6): 294-

298, ills., 1981). **T:** Mexico, Chiapas (*MacDougall* B.138 [HNT]). – **D:** Mexico (Chiapas: El Sumidero).

[5] Stem to ± 10 cm high, 1 - 1.5 cm $\varnothing$, rarely branching; **Ros** 14 - 15 cm $\varnothing$; **L** spatulate-obovate, obtuse, mucronate, 6 - 9 $\times$ 2.5 - 4.5 cm wide near tip, young **L** violet, heavily glaucous, older **L** reddish-green, not glaucous; **Inf** cymes of 1 - 2 cincinni, 19 - 24 cm, violet, glaucous; **Bra** spatulate, obtuse; cincinni 6 - 11 cm long, with 6 - 14 **Fl**; **Ped** 4 - 8 mm; **Sep** ascending-spreading, 6 - 7 $\times$ 2 - 2.5 mm; **Cl** pentagonal, 10 - 13 $\times$ ± 8 mm $\varnothing$ just above the base; **Pet** lanceolate, acute, exterior glaucous-pink. – *Cytology*: $n = 28+1$.

The nearest allies are *E. scheeri* and *E. fulgens*.

E. $\times$ pulchella A. Berger *pro sp.* (Gartenflora 53: 206, fig. 31 (p. 204), 1904). **T:** not indicated.

Stem to 6 cm tall, branching; **L** oblong-spatulate, to over 3.5 $\times$ 1.5 cm, mucronate, green, often tinged red, not glaucous; **Inf** cymose-paniculate, 2- to 3-branched, to 20 cm tall; **Ped** 5 mm, stout; **Sep** appressed, united for $\frac{1}{2}$ their length; **Cl** to 8 $\times$ 6 mm $\varnothing$ near the base, 4 mm $\varnothing$ at the mouth, scarlet.

Similar to $\times$ *Cremneria expatriata* and, like it, a probable hybrid with *E. amoena* or *Cremnophila linguifolia* as one parent, and thus perhaps belonging to $\times$ *Cremneria*.

E. pulidonis E. Walther (Echeveria, 122, ill., 1972). **T:** Mexico, Hidalgo (*Pulido* s.n. [CAS]). – **D:** Mexico (Hidalgo: Beristain).

[16] Plant nearly stemless, glabrous; stem branching; **Ros** 7 - 9 cm $\varnothing$; **L** obovate-oblong, minutely mucronate, 3.5 - 5 $\times$ 1.2 - 1.5 cm, green, conspicuously red-margined; **Inf** a cincinnus, apical portion strongly nodding in bud, to 18 cm long; **Ped** 6 mm; **Cl** bluntly pentagonal, to 10 mm long, yellow; **Pet** strongly recurving apically. – *Cytology*: $n = 32, 62, 64$.

Attractive because of its fresh-green leaves with red margins and its yellow flowers.

E. pulvinata Rose (Bull. New York Bot. Gard. 3(9): 5-6, 1903). **T:** Mexico, Oaxaca (*Rose & Hough* 4994 [US]). – **D:** Mexico (Oaxaca). **I:** Walther (1972).

$\equiv$ *Cotyledon pulvinata* (Rose) Hooker fil. (1903).

[4] Plants entirely hirsute except inside **Fl**; stem to 10 cm tall or more, branching; **L** subrosulate, obovate, mucronate, 3.5 - 7 $\times$ 2 - 2.5 cm, 6 - 7 mm thick, green but densely covered with white or reddish **Ha**; **Inf** spicate to racemose, or subpaniculate below, to 12 cm tall; **Ped** 1 - 1.5 cm, the lowest often with 2 or more **Fl**; **Sep** appressed, $< \frac{1}{2}$ as long as **Cl**, to 12 mm; **Cl** to 16 $\times$ 9 mm $\varnothing$ near the base, 7 - 12 mm $\varnothing$ at the mouth, red. – *Cytology*: $n = 23$.

A highly decorative species, esp. in the forms with reddish-hirsute leaves. An attractive white-haired form, 'Frosty', was found by A. Lau at San Miguel Maninaltepec (Oaxaca).

E. purpusorum A. Berger (NPF2 18a: 476, 1930). **T:** Mexico, Puebla / Oaxaca (*Purpus & Purpus* s.n. [US]). – **D:** Mexico (Puebla: near San Luis Atolotitlán). **I:** Walther (1972).

Incl. *Urbinia purpusii* Rose (1911).

[16] Stem usually 5 - 8 cm high, ± 2 cm $\varnothing$, rarely branching; **Ros** 6 - 7 cm $\varnothing$ and high; **L** ovate-acuminate, acute, $\pm 3 - 3.5 \times 2 - 2.5$ cm, to 1 cm thick, sharp-edged, obscurely keeled on the back, light olive-green, heavily mottled and spotted with irregular reddish-brown markings, margin translucent, unspotted; **Inf** a cincinnus, unbranched, to 20 cm tall; **Ped** to 12 mm; **Sep** appressed; **Cl** globose-urceolate, to 12 mm long, rose below, scarlet above, yellow at the tips. – *Cytology*: $n = 27$.

One of the most handsome and distinct of echeverias, notable for its mottled leaves. It rarely offsets but is easily propagated from leaves.

E. quitensis (Kunth) Lindley (J. Hort. Soc. London 7: 268, 1852). **T:** Ecuador (*Humboldt & Bonpland* 3096 [P]). – **D:** Colombia, Ecuador.

$\equiv$ *Sedum quitense* Kunth (1823) $\equiv$ *Cotyledon quitensis* (Kunth) Baker (1869).

E. quitensis var. **quitensis** – **D:** Colombia, Ecuador. **Fig. XIV.e**

Incl. *Echeveria aequatorialis* Rose ex von Poellnitz (1935); **incl.** *Echeveria columbiana* von Poellnitz (1935); **incl.** *Echeveria pachanoi* Rose ex von Poellnitz (1935); **incl.** *Echeveria quitensis* var. *gracilior* Sodiro ex von Poellnitz (1935) (*nom. inval.*, Art. 34.1a).

[8] Stem to 20 - 40 cm tall, much-branched; **L** scattered or subrosulate, oblanceolate to obovate, 1 - 6 $\times$ 1 - 1.5 cm, obtuse, mucronate, green, grey-green to bluish, margins sometimes reddened; **Inf** racemes, 10 - 25 cm; **Ped** spreading to ascending, to 1 cm; **Sep** ascending to spreading; **Cl** 8 - 15 $\times$ ± 11 mm $\varnothing$ near the base, yellow below to scarlet above. – *Cytology*: $n = 21$.

An extremely variable taxon in leaf shape and colour.

E. quitensis var. **sprucei** (Baker) von Poellnitz (RSN 39: 232, 1936). **T:** Ecuador (*Spruce* 5463 [K]). – **D:** Ecuador. **I:** Walther (1972: 291, as *E. sprucei*). **Fig. XIV.f**

$\equiv$ *Cotyledon sprucei* Baker (1869) $\equiv$ *Echeveria sprucei* (Baker) A. Berger (1930).

[8] Differs from var. *quitensis*: **Ped** recurving; **Sep** reflexed – *Cytology*: $n = 22$.

E. racemosa Schlechtendal & Chamisso (Linnaea 5: 554, 1830). **T:** Mexico, Veracruz (*Schiede* 520 [HAL $\dagger$?]). – **D:** Mexico (Veracruz).

E. racemosa var. **citrina** Kimnach (CSJA 56(2): 73-75, ills., 1984). **T:** Mexico, Veracruz (*Whitelock* s.n. [HNT, CAS, MEXU, US]). – **D:** Mexico (Veracruz: W of Palma Sola).

[12] Differs from var. *racemosa*: **L** lighter-green; **Cl** yellow.

E. racemosa var. *racemosa* – **D**: Mexico (Veracruz: Mirador, Xalapa de la Banderilla). **I**: Walther (1972).

Incl. *Echeveria lurida* Haworth (1831) $\equiv$ *Cotyledon lurida* (Haworth) Baker (1869); **incl.** *Echeveria lucida* Steudel (1840).

[12] Stem < 5 cm long, 1 - 1.5 cm $\varnothing$, sparsely branching; **L** rosulate, narrowly oblong-oblancoate, acute, 5 - 10 $\times$ 1.5 - 2.5 cm, upper face deeply concave, green to reddish-brown; **Inf** racemes 30 - 50 cm; **Bra** easily detached; **Ped** 4 - 10 mm; **Sep** widely spreading to reflexed, the longest < 5 mm; **Cl** conoid-urceolate, 9 - 15 mm long, bright red. – *Cytology*: n = 18.

An inhabitant of warm damp regions, it often grows epiphytically or on walls and roofs. In cultivation it can spread quickly by its easily-detached bracts.

E. recurvata L. Carruthers (Bull. Afr. Succ. Pl. Soc. 9: 50-56, ill., 1974). **T**: Venezuela, Mérida (Carruthers 106 [E]). – **D**: Venezuela (Mérida). **I**: Uhl (1992: as *E. multicolor*).

Incl. *Echeveria multicolor* C. H. Uhl (1992) (*nom. illeg.*, Art. 52.1).

[8] Stem nearly lacking or in some populations to 15 cm tall, sparsely branching; **L** ovate to lanceolate, sometimes oblanceolate, 4 - 5 (-9) $\times$ 1.5 - 2.5 cm, 3 - 4 mm thick, sometimes mucronate, straight or recurving, usually very glaucous and pale blue but often intergrading to olive or dark brown; **Inf** racemose, 25 - 60 cm tall, **Fl** rather crowded, 15 - 40, horizontal to drooping; **Ped** to 4 mm; **Sep** erect, clasping the **Cl**; **Cl** rather gibbous, 8 - 13 $\times$ 5 - 7 mm $\varnothing$, 4 - 6 mm $\varnothing$ at the mouth, yellow or orange, often tinged reddish. – *Cytology*: n = 21.

Allied to *E. bicolor*, differing in its usually shorter (or lacking) stems and denser, horizontal or drooping flowers with erect sepals.

E. rodolfi Martínez-Ávalos & Mora-Olivo (Acta Bot. Mex. 52: 43-45, ill., 2000). **T**: Mexico, Tamaulipas (Martínez-Ávalos 819 [UAT]). – **D**: Mexico (Tamaulipas).

[1] Stem short; **Ros** 16 - 23 cm $\varnothing$; **L** 24 or more, glabrous, broadly lanceolate, cymbiform, 9 - 14.5 $\times$ 6 - 8.5 cm, fleshy, reddish but whitish and green near the base, conspicuously keeled near the base; **Inf** a single cincinnus to > 45 cm; **Bra** whitish-green; **Ped** 6 mm; **Sep** differing greatly in size, the largest 16 mm; **Cl** 10 mm long, rose.

E. rodolfi has the widest leaves of any species of Ser. *Angulatae*.

E. rosea Lindley (Edward's Bot. Reg. 28: t. 22 + text, 1842). **T**: Mexico (*Anonymus* s.n. [CGE]). –

D: Mexico (Hidalgo, Puebla, San Luis Potosí, Veracruz, Guerrero, Oaxaca, Chiapas); usually epiphytic in cloud forests. **I**: Walther (1972).

$\equiv$ *Cotyledon rosea* (Lindley) Baker (1869) (*nom. illeg.*, Art. 53.1) $\equiv$ *Courantia rosea* (Lindley) Britton & Rose (1903); **incl.** *Courantia echeverioides* Lemaire (1851); **incl.** *Cotyledon roseata* Baker (1869); **incl.** *Echeveria chiapensis* Rose ex von Poellnitz (1936); **incl.** *Echeveria omiltemiana* Matuda (1963).

[14] Plants glabrous; stem erect to pendent, 10 - 60 cm long or more, sparsely branching, 3 - 10 mm $\varnothing$; **Ros** diffuse, 5 - 11 cm $\varnothing$; **L** elliptic-oblong to oblanceolate or spatulate, acute or obtuse, often acuminate-cuspidate, spurred at the base, 3.5 - 9 $\times$ 1.5 - 2.5 cm, 2 - 5 mm thick, yellowish-green or reddish; **Inf** dense spikes or racemes 10 - 50 cm long; **Fl** densely crowded into a terminal portion 3 - 13 cm long and 2.5 - 3.5 cm $\varnothing$; **Bra** conspicuous on the flowering portion of the **Inf**, as long as the **Fl**, 12 - 16 $\times$ 1.5 - 3 mm or longer, reddish; **Ped** 0.5 - 7 mm; **Sep** erect and pressed against the **Pet**, narrowly elongate, $\pm$ as long as the **Cl**, deep red to pink; **Cl** 9 - 13 $\times$ 7 - 8 mm $\varnothing$, light yellow. – *Cytology*: n = 34.

One of the few epiphytic echeverias, this is a denizen of cool damp forests, where its vivid pink inflorescences are often conspicuous.

E. rubromarginata Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 23, 1905). **T**: Mexico, Veracruz (*Purpus* 930 [US]). – **D**: Mexico (Veracruz, Puebla). **I**: Walther (1972: 189-191).

Incl. *Echeveria gloriosa* Rose (1911).

[5] Stem usually single, short, $\pm$ 3 cm $\varnothing$; **L** rosulate, obovate or widely oblanceolate, 11 - 17 $\times$ 7 - 9 cm, obtuse and mucronate to acute, light green tinged purplish, red-margined, slightly glaucous; **Inf** narrowly cymose-paniculate, to > 1 m, with 6 - 12 **Br**, each with $\pm$ 5 **Fl**; **Ped** 1 - 2 mm; **Sep** to 13 mm, ascending; **Cl** $\pm$ 14 $\times$ 11 mm $\varnothing$; **Pet** red. – *Cytology*: n = 27.

E. runyonii Rose ex E. Walther (CSJA 7: 69, ill., 1935). **T**: Mexico (*Runyon* 339 [US]). – **D**: Mexico (Nuevo León). **I**: Walther (1972).

Incl. *Echeveria runyonii* var. *macabeana* E. Walther (1935).

[11] Stem usually single, to 10 cm long or more, $\pm$ 1 cm $\varnothing$; **Ros** 8 - 10 cm $\varnothing$; **L** spatulate-cuneate to oblong-spatulate, truncate to acuminate, mucronate, 6 - 8 $\times$ 2.5 - 4 cm, glaucous pinkish-white; **Inf** 2 or more, 15 - 20 cm tall, with 2 - 3 cincinni; **Bra** conspicuous; **Ped** $\pm$ 4 mm; **Sep** ascending-spreading, to 11 mm; **Cl** pentagonal, 19 - 20 $\times$ 10 mm $\varnothing$, scarlet. – *Cytology*: n = 14.

Long a species of mysterious origin, it has recently been found wild in Nuevo León. An interesting mutation, with leaves appearing to be positioned upside-down, is 'Topsy Turvy', which originated in cultivation in California.

E. *×sayulensis* E. Walther *pro sp.* (Echeveria, 151-152, 1972). **T:** CAS. – **I:** Uhl (1989).

Stem short, branching; **Ros** to > 25 cm Ø; **L** obovate-spatulate, obtuse, mucronate, $\pm 14 \times 7$ cm, green, slightly glaucous; **Inf** paniculate, to 36 cm tall; **Ped** to 12 mm; **Sep** widely spreading; **Cl** $17 \times \pm 10$ mm Ø near the base, pink. – *Cytology*: $n = 43$.

Believing this to be a hybrid, Uhl crossed *E. secunda* with *E. grandifolia* (= *E. gibbiflora*) and obtained plants that were identical to *E. ×sayulensis* in both morphology and cytology (Uhl 1989).

E. schaffneri (S. Watson) Rose (Bull. New York Bot. Gard. 3(9): 9-10, 1903). **T:** Mexico, San Luis Potosí (*Schaffner* 768 [GH]). – **D:** Mexico (San Luis Potosí: NW of Cedral on road to Catorce; Nuevo León).

≡ *Cotyledon schaffneri* S. Watson (1882) ≡ *Echeveria teretifolia* var. *schaffneri* (S. Watson) E. Walther (1935).

[1] **R** tuberous (?); stem usually < 5 cm long, rarely branching; **L** rosulate, narrowly lanceolate, acuminate, canaliculate, $7.5 - 10 \times \pm 1.5$ cm, green, sometimes purplish, not glaucous; **Inf** of 2 cincinni, to 30 cm tall; **Ped** very short; **Sep** to 8 mm; **Cl** $14 - 17$ mm long, yellow and pink. – *Cytology*: $n = 12$.

According to Uhl (1999), *E. schaffneri* is distinctive in growing "on sandy, gravelly outwashes at the foot of the mountains and on flat land out on the dry plateau W of the Sierra Madre Oriental. The type locality is on sand hills near the city of San Luis Potosí." He states that some of the data and the description by Walther (1972) applies to *E. walpoleana*, which grows on the damper E side of the mountains and has red-margined leaves.

E. scheeri Lindley (Edward's Bot. Reg. 31: t. 27 + text, 1845). **T:** CGE. – **D:** Mexico (SE Oaxaca: Chontal region?).

≡ *Cotyledon scheeri* (Lindley) Baker (1869).

[5] Stem to 10 cm tall, sparsely branching; **L** rosulate, obovate-cuneate, mucronate, 9×4 cm, upper face deeply concave, glaucous, green with red margins; **Inf** cymose-paniculate, 2- or 3-branched, to 50 cm tall or more; **Ped** 10 - 13 mm; **Sep** to 18 mm, widely spreading; **Cl** pentagonal, ± 25 mm long, 14 mm Ø near the base, 18 mm Ø at the mouth, orange to pink.

Walther (1972) stated that T. MacDougall rediscovered this species in the Chontal region of Oaxaca, and gave a description and photo of the plant. However, no exact locality was ever published nor is the species mentioned in MacDougall's published fieldnotes.

E. secunda Booth (Edward's Bot. Reg. 24: Misc.: 59, 1838). **T:** [neo – icono]: l.c. 26: t. 57, 1840. – **D:** Mexico (Hidalgo, Guanajuato, Distrito Federal, Puebla, México, Tlaxcala). **I:** Walther (1972).

≡ *Cotyledon secunda* (Booth) Baker (1869); **incl.** *Echeveria pumila* Van Houtte (1846) ≡ *Cotyledon pumila* (Van Houtte) Baker (1869) ≡ *Echeveria secunda* var. *pumila* (Van Houtte) Otto (1873) ≡ *Echeveria glauca* var. *pumila* (Van Houtte) von Poellnitz (1936); **incl.** *Echeveria spilota* Kunze (1853); **incl.** *Cotyledon glauca* Baker (1869) ≡ *Echeveria secunda* var. *glauca* (Baker) Otto (1873) ≡ *Echeveria glauca* (Baker) Morren (1874) ≡ *Echeveria pumila* var. *glauca* (Baker) E. Walther (1972); **incl.** *Echeveria alpina* E. Walther (1935); **incl.** *Echeveria elatior* E. Walther (1935); **incl.** *Echeveria cornuta* E. Walther (1972); **incl.** *Echeveria reglensis* E. Walther (1972).

A popular and easily grown species, highly variable in leaf-shape, pedicel length and degree of sepal expansion. On Ixtaccihuatl it has been found as high as 4275 meters. Plants from Epazoyucán, Hidalgo, have unusually narrow and succulent leaves. 2 forms can be recognized:

E. secunda fa. *byrnesii* (Rose) Kimnach (Haseltonia 5: 52, 1998). **T:** Mexico, México (*Rose & Painter* 7991 [US]). – **D:** Mexico (México: Ojo del Agua, Tultenango Canyon). **I:** CSJA 6: 139, 1935, as *E. byrnesii*.

≡ *Echeveria byrnesii* Rose (1905) ≡ *Echeveria secunda* var. *byrnesii* (Rose) von Poellnitz (1936).

[13] Differs from var. *secunda*: **Ros** $\pm 10 - 12$ cm Ø; **L** oblong-obovate-cuneate, mucronate, $5 - 9 \times \pm 3.5$ cm, thin and flat, green. – *Cytology*: $n = 32$.

An alpine variant of *E. secunda*, distinctive because of its green leaves.

E. secunda fa. *secunda* – **D:** Mexico (Hidalgo, Guanajuato, Distrito Federal, Puebla, México, Tlaxcala). **I:** Walther (1972).

[13] Stem usually < 5 cm long, ± 1 cm Ø, branching; **Ros** 5 - 10 (-15) cm Ø; **L** cuneate-obovate, obtuse to truncate, mucronate, $2 - 5 (-8) \times 1.5 - 3 (-4.5)$ cm, ± 5 mm thick, margins thin to obtuse, blue-glaucous; **Inf** a cincinnus, 5 - 15 cm tall; **Ped** 4 - 15 mm; **Sep** ascending to spreading; **Cl** pentagonal with channelled sides, (8-) 10 - 11 (-13) $\times 7 - 8$ mm Ø near the base, 5 - 6 mm Ø at the mouth, orange-red to deep pink. – *Cytology*: $n = 30, 32$.

E. semivestita Moran (CSJA 16(2): 60, 174-176, ill., 1954). **T:** Mexico, Hidalgo (*Taylor* s.n. [UC]). – **D:** Mexico (Hidalgo, Nuevo León, San Luis Potosí, Tamaulipas).

E. semivestita var. *floresiana* E. Walther (CSJA 30(4): 107-109, ill., 1958). **T:** Mexico, San Luis Potosí (*Flores* s.n. [CAS]). – **D:** Mexico (San Luis Potosí, Tamaulipas).

[5?] Differs from var. *semivestita*: Plants entirely glabrous; stem < 5 cm; **L** margins often minutely undulate. – *Cytology*: $n = 17$.

E. semivestita var. **semivestita** – **D:** Mexico (Hidalgo, Nuevo León, San Luis Potosí). **I:** Walther (1972).

[5?] Stem 10 - 15 cm long, ± 1 cm $\varnothing$, glabrous, rarely branching; **Ros** ± 12 cm $\varnothing$; **L** subrosulate, oblanceolate, acute, concave above, 7 - 14 $\times$ 1.5 - 3 cm, glabrous or minutely pubescent, green, margins purplish-red; **Inf** paniculate, to 55 cm tall, with 3 - 9 secund-racemose **Br**, each with 6 - 9 **Fl**, peduncle puberulent below, above papillose or glabrous; **Bra** puberulent or glabrous; **Ped** 1 - 7 mm; **Sep** glabrous, to 15 mm, green to purplish or bluish-glaucous, pruinose; **Cl** glabrous, 13 mm long, pink to red. – *Cytology*: $n = 17$.

There is some question as to the proper series for this species. The bluish sepals of the buds are a unique feature in the genus.

E. sessiliflora Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 15, 1905). **T:** Mexico, Chiapas (*Goldman* 978 [US]). – **D:** Mexico (Chiapas). **I:** Walther (1972).

Incl. *Echeveria corallina* Alexander (1941).

[7] **R** not tuberous; stem 2 - 3 cm long, branching; **L** rosulate, oblanceolate, abruptly acute, mucronate, 6 - 8 $\times$ 1.5 - 1.6 cm, pale green with brownish-purple margins, very glaucous; **Inf** spicate, ± 15 - 30 (-40) cm long; **Ped** ≤ 1 mm; **Sep** appressed; **Cl** 8 - 14 mm long, coral-red. – *Cytology*: $n = 15$.

E. setosa Rose & Purpus (CUSH 13: 45, ill., 1910). **T:** Mexico, Puebla (*Purpus* 415 [US 592 487]). – **D:** Mexico (Puebla, Oaxaca).

A variable species separable into the following varieties, though some intermediate forms exist:

E. setosa var. **ciliata** (Moran) Moran (CSJA 65(1): 32-33, ill., 1993). **T:** Mexico, Oaxaca (*Moran* 6395 [SD]). – **D:** Mexico (Oaxaca: SE of Huajuapán). **I:** Walther (1972: as *E. ciliata*).

= *Echeveria ciliata* Moran (1961).

[3] Differs from var. *setosa*: **Ros** 5 - 13 cm $\varnothing$, branching; **L** obovate-cuneate, obtuse, mucronate, 2.5 - 6 $\times$ 1.5 - 3.7 cm wide above, 5 - 9 mm thick, green, margins and keel ciliate, surface glabrous or slightly hirsute; **Inf** with 3- to 14- (to 24-) flowered cincinni; **Ped** 6 - 35 mm; **Cl** 10 - 16 $\times$ 6.5 - 10 mm $\varnothing$.

E. setosa var. **deminuta** J. Meyrán (Cact. Suc. Mex. 34(4): 75-79, ill., 1989). **T:** Mexico, Oaxaca (*Otero* 42 [MEXU, ENCB]). – **D:** Mexico (Oaxaca: Sierra Mixteca). **Fig. XIV.g**

Incl. *Echeveria rondelii* Hort. Sterk (1989) (*nom. inval.*, Art. 36.1).

[3] Stem 6 - 8 mm $\varnothing$, copiously branching; **Ros** 2 - 6 (-7) cm $\varnothing$; **L** oblanceolate, acute, 1 - 3 $\times$ 0.4 - 0.9 cm wide above, 1.5 - 5 mm thick, glabrous or commonly with a few white **Ha** near tip or sometimes on margins or keel, green or at first glauc-

ous; **Inf** glabrous or somewhat hirsute except inside **Fl**, 3 - 16 cm long, 1.5 - 3 mm $\varnothing$, cincinni 2- to 7-flowered; **Ped** 9 (-27) mm; **Cl** 8 - 12 $\times$ 4 - 7 mm $\varnothing$. – *Cytology*: $n = 25$.

Because of its minute fuzzy mat-forming rosettes, this variety is an ideal dish-garden plant.

E. setosa var. **minor** Moran (CSJA 65(1): 33-35, ill., 1993). **T:** Mexico, Oaxaca (*Fittkau* s.n. [SD 93245, BH, CAS]). – **D:** Mexico (Oaxaca: Sierra Mixteca, near Tepelmeme de Morelos).

[3] Stem ± 2 cm long and 4 mm $\varnothing$, branching; **Ros** 4.5 - 7 cm $\varnothing$; **L** cuneate-spatulate or -oblanceolate, subacute to obtuse, 2 - 3 $\times$ 0.7 - 1 cm wide above, 3 - 4 mm thick, hirsute on upper $\frac{3}{4}$ and extending lower along margins; **Inf** 9 - 19 cm, cincinni 4- to 12-flowered; **Ped** 5 - 10 mm; **Sep** ascending, 4 - 8 mm; **Cl** 11 - 12 $\times$ 8 - 9 mm $\varnothing$. – *Cytology*: $n = 25$.

E. setosa var. **oteroi** Moran (CSJA 65(1): 33-34, ill., 1993). **T:** Mexico, Oaxaca (*Otero* 26 [SD 93237, BH, CAS, HNT, SD]). – **D:** Mexico (Oaxaca: Sierra Mixteca, 5 km N of Concepción de Buenavista).

[3] Stem 7 - 15 mm $\varnothing$, sparsely branching; **Ros** 5 - 15 cm $\varnothing$; **L** rhombic-spatulate to -obovate, obtuse, mucronate, 2.5 - 8 $\times$ 1.3 - 3.4 cm wide above, 3 - 10 mm thick, some clones glabrous throughout, others densely ciliate and with sparse **Ha** on the upper keel and surface, glaucous, later green; **Inf** 10 - 20 cm, glabrous to sparsely hirsute, cincinni 5- to 11-flowered; **Ped** 6 - 22 mm; **Sep** slightly ascending, 5 - 10 mm; **Cl** 11 - 13 $\times$ 6 - 9 mm $\varnothing$. – *Cytology*: $n = 25$.

Vegetatively, the glabrous clones of this variety seem unrelated to *E. setosa*, but the flowers are almost identical.

E. setosa var. **setosa** – **D:** Mexico (Puebla: San Luis Atlotitlán, Cerro de la Yerba). **I:** Walther (1972: t. 14 upper, fig. 213-215). **Fig. XV.a**

[3] Stem to 10 cm long, 1 - 2 cm $\varnothing$, branching; **Ros** 5 - 12 cm $\varnothing$; **L** oblanceolate-spatulate, acute becoming obtuse, apiculate, (2.5-) 4 - 7 $\times$ 0.8 - 2 cm wide above, 5 - 7 mm thick, green, hirsute, ciliate with **Ha** 2 - 3 mm long; **Inf** a cincinnus, hirsute except inside **Fl**, 10 - 30 cm long; **Ped** 1 - 3 cm; **Sep** spreading; **Cl** (8-) 10 - 15 $\times$ (6-) 8 - 10 mm $\varnothing$, orange-red below, yellow near the tip. – *Cytology*: $n = 25$.

E. shaviana E. Walther (*Echeveria*, 270, t. 5, fig. 142, 1972). **T:** Mexico, Nuevo León (*Meyer & Rogers* 48/2527 [MO 1598523, G]). – **D:** Mexico (Tamaulipas, Nuevo León). **I:** CBM 183: t. 797, 1980.

[1] Plants glabrous; stem usually < 5 cm long, ± 1 cm $\varnothing$, sparsely branching; **Ros** 8 - 10 cm $\varnothing$; **L** obovate-spatulate, mucronate, the whitish margins $\pm$ undulate-crispate, 3 - 5 $\times$ 1.5 - 2.5 cm, thin, glauc-

ous-greenish to -pinkish; **Inf** with 1 - 2 cincinni, to 30 cm tall; **Ped** < 2 mm; **Sep** ascending; **Cl** 10 - 13 mm long, pentagonal, rose. – *Cytology*: $n = 13$.

Based on its cytology, Uhl (1999) believes this species is better placed in Ser. *Angulatae* than in Ser. *Pruinosae*, where Walther assigned it. A popular, decorative species, it is difficult to maintain in cultivation, losing its roots easily and attracting mealy bugs. It is native to shaded areas, where it grows in pine-needles on boulders.

E. simulans Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 22, 1905). **T**: Mexico, Nuevo León (*Pringle* 767 [US]). – **D**: Mexico (Nuevo León). **I**: Walther (1972). **Fig. XIV.h**

≡ *Echeveria elegans* var. *simulans* (Rose) von Poellnitz (1936).

[16] Stem nearly lacking, sparsely and slowly branching; **Ros** to > 10 cm Ø; **L** loosely rosulate, obovate, mucronate, to 7 × 4 cm, glaucous, greenish-white; **Inf** with 1 - 2 cincinni, 20 - 40 cm tall; **Ped** to 10 mm or more; **Sep** ± appressed; **Cl** conoid-urceolate, to 15 × 10 mm Ø near the base, rose-pink, yellowish at the tip. – *Cytology*: $n = 32$.

Distinguished from the numerous forms of *E. elegans* by its larger, less compact rosettes and larger leaves and corolla.

E. skinneri E. Walther (*Echeveria*, 307, ill., 1972). **T**: Mexico, Oaxaca (*MacDougall* B.204 [CAS]). – **D**: Mexico (Oaxaca: Cerro Madreña). **Fig. XV.b**

[8] Stem branching, to 30 cm tall or more, 6 - 8 mm Ø; **L** scattered along the stems, terminal **L** subrosulate, obovate-cuneate, obtuse, 3 - 4 × 1.5 - 2 cm, often slightly mucronate, smooth, green, margins reddened in strong light; **Inf** racemose, 15 - 20 cm tall; **Ped** somewhat recurving, 10 - 16 × 2 mm Ø; **Sep** subterete, widely spreading to recurving, to 10 mm; **Cl** conoid-urceolate, sharply pentagonal, 17 - 20 × 15 mm Ø near the base, scarlet, margins yellow. – *Cytology*: $n = \pm 40$.

E. spectabilis Alexander (CSJA 13: 137, ill., 1941). **T**: Mexico, Oaxaca (*MacDougall* s.n. [NY]). – **D**: Mexico (Oaxaca: Sierra Juárez, near Macuiltianguis and Benito Juárez, Mitla). **I**: Walther (1972). **Fig. XV.c**

[8] Stem to 60 cm tall, ± 8 mm Ø, branching; **Ros** 4 - 5 cm Ø; **L** subrosulate, obovate-spatulate, mucronate, 4 - 7 × 2.5 - 3 cm, muriculate (sparsely and minutely papillose), green, red-margined; **Inf** racemose, to 70 cm tall; **Ped** recurved, 1 - 3.5 cm; **Sep** ascending-spreading, to 18 mm; **Cl** pentagonal, 22 - 24 × 18 mm Ø near the base, scarlet to orange, yellow-margined. – *Cytology*: $n = \pm 105$.

Worthy of cultivation because of its large attractive flowers.

E. steyermarkii Standley (Publ. Field Mus. Nat.

Hist., Bot. ser. 23(4): 160, 1944). **T**: Guatemala, Zacapa (*Steyermark* 43145 [F]). – **D**: Guatemala (Solola, San Marcos, Huehuetenango, Zacapa); epiphytic or on rocks, 1300 - 3700 m.

[5] Stem to 5 cm long and 1 cm Ø, usually unbranched; **L** 12 to many, rosulate, oblong-obovate to oblong-spatulate or oblanceolate, tapered towards base, obtuse to acute, apiculate or shortly cuspidate-mucronate, ± 4 - 15 × 1 - 5.5 cm, green tinged purplish or rose; **Inf** simple or 2-branched racemes 5 - 20 cm long, < 2 mm Ø near base, each raceme with 3 - 5 **Fl**; **Ped** 5 - 15 mm; **Sep** spreading to reflexed, 4 - 8 mm; **Cl** ± 11 × 8 mm Ø near the base, red or reddish-yellow; **Pet** with yellow margins.

A little-known species, neither cultivated nor illustrated.

E. stolonifera (Baker) Otto (Hamburg. Gart.- & Blumenzeit. 29: 9, 1873). **T**: [lecto - icono]: *Refug. Bot.* 1: t. 63, 1869. – **D**: Not known. **I**: Walther (1972).

≡ *Cotyledon stolonifera* Baker (1869).

[?] Stem to 10 cm long above ground, branching; **L** obovate, cuspidate, to 5 cm long, concave above, glabrous, greyish-green; **Inf** 6 - 10 cm tall, secund; **Ped** 6 - 8 mm; **Sep** to 10 mm, spreading; **Cl** 14 × 9 mm Ø, reddish.

Although originally considered as a species, there is no known locality in Mexico. Walther (1972) found similar plants spontaneously appearing in his research collection and theorized that *E. stolonifera* was a hybrid, the most likely parents being *E. glauca* (= *E. secunda*) and *E. grandifolia* (= *E. gibbiflora*).

E. strictiflora A. Gray (Pl. Wright. 76, 1852). **T**: USA, Texas (*Anonymus* s.n. [G]). – **D**: USA (Texas), Mexico (Coahuila, Chihuahua?, Nuevo León?). **I**: Walther (1972).

≡ *Cotyledon strictiflora* (A. Gray) Baker (1869).

[1] Stem < 3 cm tall, 0.5 - 1.5 cm Ø, rarely branching; **L** rosulate, ascending-spreading, oblanceolate-rhombic, acute, 3 - 9 × 1.5 - 3 cm, grey-green or buff-green, with or without a red margin; **Inf** secund-racemose, unbranched or rarely 2-branched, 20 - 25 cm tall; **Ped** ± 1 mm; **Sep** ascending, 9 - 13 mm; **Cl** conoid to urceolate-campulanate, strongly pentagonal, rose near the base, yellowish-red above, 13 - 15 × 8 mm Ø near the base, 5 mm Ø at the mouth. – *Cytology*: $n = 12$.

Of interest as the only echeveria native to the USA. It is also one of the more difficult species to cultivate. Some populations in Texas and Mexico have red-margined leaves but seem to be uncorrelated geographically. A plant collected by A. Lau in the Sierra Gomas W of Bustamante, Nuevo León, has unusually broad leaves (to 4 cm wide) and after further study may be proposed as a new variety or species.

E. subalpina Rose & Purpus (CUSNH 13: 45, ill., 1910). **T:** Mexico, Puebla / Veracruz (*Purpus* s.n. [US]). – **D:** Mexico (Puebla, Tlaxcala, Veracruz). **I:** Walther (1972). **Fig. XV.g**

Incl. *Echeveria akontiphylla* Werdermann (1932); **incl.** *Echeveria meyranaiana* E. Walther (1959).

[13] Stem < 4 cm tall, rarely branching; **Ros** 4 - 10 cm Ø; **L** oblanceolate to linear-oblanceolate, long-acuminate, cuspidate, 2.5 - 5 (-14) × 1 - 1.5 cm, glaucous-green, mucro reddish; **Inf** a single or 2-branched cincinnus, to 30 cm long; **Ped** 4 - 8 (-22) mm; **Sep** widely spreading; **Cl** 10 - 12 × 6 - 8 mm Ø near the base, orange to red, **Pet** margins yellow. – *Cytology:* n = 34.

The collection from Tlaxcala (Mun. Temezontla, Cerro Cuatlapangas) has smaller leaves and more caespitose rosettes.

E. subcorymbosa Kimnach & Moran (CSJA 66(1): 11-15, ill., 1994). **T:** Mexico, Oaxaca (*Lau* 30 [HNT, MEXU]). – **D:** Mexico (Oaxaca: N of Santiago Juxtlahuaca). **Fig. XV.h**

[12] Stem usually < 4 cm long, 5 - 8 mm Ø; **Ros** 4 - 6 cm Ø; **L** obovate-spatulate, cuspidate, 1.5 - 3 × 0.8 - 2.5 cm wide at the widest part, glaucous bluish-grey, often red-flecked beneath, margins reddish; **Inf** 4.5 - 11 cm, racemose but appearing corymbose because of the long lower **Ped**; **Ped** suberect, 1 - 3 cm, the lowest the longest, each with 1 - 3 minute **Bra**; **Fl** 3 - 12; **Sep** slightly ascending, 5 - 11 × 2 - 3 mm; **Cl** ovoid, pentagonal, 8 - 14 × 6 - 8 mm Ø, 3 - 4 mm Ø at the mouth; **Pet** oblong, subobtuse, lower portion reddish-orange, upper part yellow. – *Cytology:* n = 29.

The population from Tlacotepec has much wider leaves and may be deserving of varietal status.

E. subrigida (Robinson & Seaton) Rose (Bull. New York Bot. Gard. 3(9): 10, 1903). **T:** Mexico, México (*Pringle* 4326 [GH]). – **D:** Mexico (México, Hidalgo, San Luis Potosí, Guanajuato, Querétaro). **I:** CBM 138: t. 8445, 1912; Walther (1972).

≡ *Cotyledon subrigida* Robinson & Seaton (1893); **incl.** *Echeveria palmeri* Rose (1903); **incl.** *Echeveria rosei* Nelson & Macbride (1913); **incl.** *Echeveria angusta* von Poellnitz (1936).

[5] Stem usually < 5 cm tall, to 5 cm Ø, rarely branching; **Ros** 15 - 20 cm Ø; **L** oblong-oblanceolate, acute or shortly acuminate, 15 - 25 × 5 - 10 cm, thick, rigid, margins somewhat upturned and often finely undulate-crenulate, white-pruinose, sometimes nearly or entirely green, margin and mucro reddened; **Inf** 1 - 2, narrowly cymose-paniculate, to 1 m tall, ± 15 mm Ø near base, to 12-branched, each **Br** with 1 - 7 **Fl**; **Ped** stout, 2 - 5 mm; **Sep** ascending, to 25 mm; **Cl** urceolate, pentagonal, to 25 × 14 mm Ø or more near the base, ± 20 mm Ø at the tip, glaucous, pink to scarlet; **Nsc** scarlet. – *Cytology:* n = 27, 54.

A showy species with usually heavily glaucous red-margined leaves. It is often confused with *E. cante*.

E. tenuis Rose (Bull. New York Bot. Gard. 3(9): 7-8, 1903). **T:** Mexico, Zacatecas (*Rose* 2640a [US]). – **D:** Mexico (Zacatecas).

[1] Stem very short or lacking; **L** forming a flat **Ros**, oblong, much-narrowed at base, acute, 4 - 5 cm long, fleshy; **Inf** a cincinnus, slender, at first nodding or scorpioid; **Ped** lacking or nearly so; **Sep** very unequal, broadly ovate to linear; **Cl** 9 mm long, colour unknown.

A questionable species known only from the type locality. Walther (1972) added other details from plants collected by F. Schmoll at an unknown locality and stated that it was related to *E. humilis*, differing in its very short pedicels, less acuminate leaves thickest near the middle, and more ascending sepals.

E. teretifolia De Candolle (PSRV 3: 401, 1828). **T:** [lecto - icono]: De Candolle, Mém. Fam. Crass., t. 6A, 1828. – **D:** Mexico. **I:** Walther (1972).

Incl. *Cotyledon subulifolia* Baker (1869) ≡ *Echeveria subulifolia* (Baker) E. Morren (1874).

[1] Stem and **L** unknown; **Inf** a bifurcate cincinnus; **Bra** ± terete; **Ped** nearly lacking; **Sep** expanded to slightly reflexed; **Cl** pentagonal.

Although this is the type species of Ser. *Angulatae*, it is based only on an incomplete drawing and cannot be identified with certainty (see remarks under *E. bifida*).

E. tobarensis A. Berger (NPF2 18a: 476, 1930). **T:** Mexico, Durango (*Palmer* 248 [US]). – **D:** Mexico (Durango).

Incl. *Urbinia lurida* Rose (1911).

[16] Stem short (?); **Ros** 6 - 8 cm Ø; **L** densely rosulate, ovate, acuminate, glabrous, 3 - 4 × 1.5 - 2.5 cm, very thick, purple or reddish; **Inf** of 2 cinnini, 25 cm long; **Sep** small, ovate, acute; **Cl** 6 - 7 mm long, dark red.

This uncultivated species is known only from the type collection. Two attempts to re-collect it at the type locality were unsuccessful.

E. tolimanensis Matuda (Cact. Suc. Mex. 3(2): 31, ill., 1958). **T:** Mexico, Hidalgo (*Matuda* 32637 [MEXU]). – **D:** Mexico (Hidalgo). **I:** Walther (1972). **Fig. XV.e**

[16] Stem less than 5 cm long, 1 - 2.5 cm Ø, rarely branching; **L** rosulate, narrowly lanceolate to linear-oblong, semiterete, upper face somewhat flattened, aristate, 4 - 9 × 1.5 - 2 cm, 8 - 13 mm Ø, lightly pruinose, greenish-white; **Inf** with 2 - 3 cinnini, 10 - 12 cm long, racemes 2 - 3, pendent; **Ped** slender, 6 - 17 mm; **Sep** spreading to reflexed; **Cl** terete-urceolate, 10 - 14 mm long, coral-pink below, orange above. – *Cytology:* n = 30.

E. tolucensis Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 22, 1905). **T:** Mexico, México (*Rose & Painter* 6818 [US]). – **D:** Mexico (México: near Toluca); 2750 m.

≡ *Echeveria glauca* var. *tolucensis* (Rose) von Poellnitz (1936).

[13] Stem nearly lacking, branching; **L** laxly to densely arranged, oblanceolate-oblong, to 10 × 3 cm wide or more, thinnish and flaccid, glaucous-green, tip deltoid-acute to shortly acuminate, margin not reddened; **Inf** with 1 - 2 cincinni, secund-racemose, to 15 cm tall or more, ± 12-flowered; **Ped** to 1 cm; **Sep** ascending; **Cl** pentagonal, to 15 × 9 mm Ø near the base, rose below, yellow above. – *Cytology*: $n = \pm 60$.

According to Uhl (1995: 38) this is a close ally of *E. secunda* but with 2× as many chromosomes.

E. trianthina Rose (CUSNH 12(10): 439-440, t. 78, 1909). **T:** Mexico, Hidalgo (*Purpus* 957 [US 399 673]). – **D:** Mexico (Hidalgo: Sierra de la Mesa).

[16] Stem to 6 cm tall or more, branching; **L** rosulate, oblanceolate, deep purple and mucronate when young, greenish and lacking a mucro later, upper face concave, 6 - 12 × 1 - 1.8 cm, very thick; **Inf** 30 - 40 cm or longer, with 1 - 3 cincinni 8 - 10 cm; **Ped** 2 - 3 mm; **Sep** deflexed; **Cl** pink, size and shape unknown. – *Cytology*: $n = 64$.

E. turgida Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 21, 1905). **T:** Mexico, Coahuila (*Purpus* 05.962 [US]). – **D:** Mexico (Coahuila: from Viesca to the Cuatrociénegas Basin). **I:** Walther (1972).

[16] Stem to 5 cm long, branching; **Ros** 3 - 8 (-12) cm Ø; **L** oblong-cuneate, obtuse to subtruncate, apiculate, fleshy, not thinning near margins, 1.5 - 4 (-6) × 1 - 2 (-2.5) cm, 4 - 8 mm thick, strongly pruinose, margin and mucro reddish; **Inf** an unbranched cincinnus, 10 - 20 cm tall; **Ped** 4 - 12 mm; **Sep** widely spreading, deltoid- to linear-lanceolate, to 1 cm; **Cl** cylindroid-conical, 9 - 13 × 5 - 8 mm Ø thick near the base, 6 - 10 mm Ø at the mouth, orange to pink. – *Cytology*: $n = 31$.

E. uhlii Meyrán (Cact. Suc. Mex. 37(4): 79-82, ill., 1992). **T:** Mexico, Oaxaca (*Otero* 41 [MEXU, ENCB]). – **D:** Mexico (Oaxaca: N of Tamazulapan, near Xochitlahuaca).

[12] Stem < 5 cm long, ± 7 mm Ø, conspicuously covered with dry **L**; **Ros** 4 - 6 cm Ø; **L** 30 - 40, obovate to spatulate, subacute to obtuse, mucronate, 1.7 - 2.5 × 1 - 1.5 cm, green, slightly pruinose; **Inf** racemes 4 - 15 cm long; **Ped** pendent from the lower side of the **Inf**, 4 - 14 mm; **Sep** nearly equal, slightly ascending, ovate; **Cl** pentagonal, 7 - 9 × 4 - 7 mm Ø, reddish-yellow.

E. unguiculata Kimnach (CSJA [in press], ill., 2002). **T:** Mexico, Nuevo León (*Debbert* s.n.

[HNT]). – **D:** Mexico (SW Tamaulipas, E San Luis Potosí).

[1] Stem to 5 cm tall or more, 1 - 1.5 cm Ø; **Ros** 8 - 10 cm Ø; **L** narrowly ovate-lanceolate, subulate, 4 - 4.5 cm long, 1.2 - 1.5 cm wide at the widest part 2 - 3 cm below the tip, 8 - 10 mm thick, purplish, mucro sharp, reddish; **Inf** racemose, to 50 cm or more, with ± 8 **Fl**; **Ped** 6 - 17 mm; **Sep** at right angles to the **Cl** to slightly recurving, very unequal, 2 - 12 mm; **Cl** subcylindrical, obtusely angled, 15 - 17 mm long, 8 - 9 mm Ø, light salmon-pink.

Notable for its sharp, claw-like leaf tip and its slightly inflated, obtusely angled corolla.

E. utcubambensis Hutchison ex Kimnach (Haseltonia 9: [in press], ill., 2002). **T:** Peru, Amazonas (*Hutchison & Wright* 4011 [UC]). – **D:** Peru (Amazonas: Prov. Gongora, Prov. Chachapoyas).

[12] Stem sprawling-pendent, 12 - 20 cm long, 5 - 12 mm Ø; **L** in terminal **Ros**, lacking below, oblong-obovate, 3 - 5.5 × 1.4 - 2.3 cm, 3 - 4 mm thick, bluish-green; **Inf** equilaterally racemose, ± 16 cm long; **Ped** ascending, 4 - 8 mm; **Sep** ascending-spreading, 5 - 8 mm; **Cl** 10 mm long, striped orange and yellow.

E. valvata Moran (CSJA 35: 152, ill., 1963). **T:** Mexico, México (*Moran* 10157 [SD]). – **D:** Mexico (México: W of Luvianos, base of Cerro Temascaltepec); 1660 - 1800 m.

[17] **R** thickened; stem < 3 cm long, single; **Ros** 8 - 15 (-20) cm Ø; **L** cuneate-spatulate to narrowly obovate, widely acute to rounded, green to reddish, glaucous when young, 4 - 10 × 2 - 3.5 cm, margins hyaline, often crisped or papillose-denticulate; **Inf** a cincinnus, to 45 cm, with 10 - 27 **Fl**; **Ped** 1 - 3 mm; **Sep** appressed or slightly spreading; **Cl** 7 - 11 × ± 8 - 9 mm Ø; **Pet** valvate, upper part red, paler below. – *Cytology*: $n = 30$.

One of the more difficult species to maintain in cultivation. The only other species of the genus with valvate petals is *E. calycosa*.

E. viridissima E. Walther (CSJA 31(1): 22, ill., 1959). **T:** Mexico, Oaxaca (*MacDougall* B.134 [CAS]). – **D:** Mexico (Oaxaca: San Pedro Mixtepec); 3000 m. **I:** Walther (1972).

[8] Stem branching, to 20 cm long or more; **Ros** ± 15 cm Ø; **L** subrosulate, ascending to spreading, obovate to cuneate, shortly mucronate, ± 10 × 6 cm, bright green, in strong light reddish along margins, tip and lower face; **Inf** racemose to subspicate above, subpaniculate below, lower **Br** 2-flowered; **Ped** 4 - 8 mm; **Sep** ascending to recurved, linear-lanceolate, to 2 cm; **Cl** pentagonal, ± 16 × 10 - 13 mm Ø, red. – *Cytology*: $n = \pm 43$.

E. walpoleana Rose (CUSNH 8: 295, 1905). **T:** Mexico, San Luis Potosí (*Palmer* 506 [US]). – **D:** Mexico (San Luis Potosí, Nuevo León, Hidalgo, Ta-

maulipas). **I:** Walther (1972: excl. fig. 134). **Fig. XV.f**

[1] Stem usually < 5 cm long, rarely branching, 1.5 - 2 cm Ø; **Ros** 10 - 18 cm Ø; **L** obovate, lanceolate, oblanceolate or rhomboid, 5 - 9 × to 2 cm, deeply concave or boat-shaped, acute, green, red-margined, often spotted red; **Inf** 30 - 40 cm or more, with 2 - 5 cincinni, each with 8 - 15 **Fl**; **Ped** stout, to 2 (-4) mm; **Sep** widely spreading, to 10 mm, red; **Cl** conoid-urceolate, sharply pentagonal, 13 - 18 × 9 - 12 mm Ø near the base, 4 - 7 mm Ø at the mouth, rose near the base, orange-red above. – *Cytology*: $n = 13$.

According to Uhl (1999), collections from Coahuila and Guanajuato cited by Walther (1972) are probably *E. bifida* or *E. strictiflora*, and Walther's fig. 134 is *E. cuspidata*.

E. waltheri Moran & J. Meyrán (Cact. Suc. Mex. 6: 77, 79-85, ill., 1961). **T:** Mexico, México (*Moran & Kimnach* 7695 [SD]). – **D:** Mexico (Guerre-ro, México).

[8] Straggly sparsely-branched minutely muriculate-papillose shrubs with stems to 90 cm and 6 - 14 mm Ø; **L** subrosulate, spatulate to rhomboid-spatulate, apiculate, 2.5 - 8 × 1 - 3 cm, 1.5 - 3 mm thick, green, reddened along margins and at tip; **Inf** 1 - 2 per stem, spicate, 25 - 70 cm, axis reddish; **Ped** lacking or to 2 mm; **Sep** erect and appressed against the **Cl**, 7 - 11 mm, papillose, reddish-green; **Cl** gaping, 11 - 16 × 6 - 12 mm Ø near the middle, white tinged reddish.

An ungainly straggling shrublet, but with striking reddish-white flowers.

E. westii E. Walther (Echeveria, 361, 1972). **T:** Peru, Cuzco (*Hutchison* 1800 [UC]). – **D:** Peru (Cuzco); 3000 m.

[12] Stem to 6 cm long or more, branching; **L** densely rosulate, rhomboid-obovate, cuneate at the base, acute, smooth, 3 - 3.5 × 1.2 - 2 cm, green, brownish near tip, or purplish-brown; **Inf** racemose but often congested, shortened and few-flowered; **Bra** easily detached; **Ped** to 9 mm; **Sep** spreading, to 10 mm, obovate-oblong, acute, thick; **Cl** urceolate, 11 - 13 mm long; **Pet** incurved apically, rose-pink, yellowish towards the tip. – *Cytology*: $n = \pm 260$.

E. whitei Rose (Addisonia 10(3): 47, t. 344, 1925). **T:** Bolivia (*White* 220 [US]). – **D:** Bolivia (La Paz, Cochabamba). **I:** Walther (1972).

Incl. *Echeveria buchtienii* von Poellnitz (1934); **incl.** *Echeveria rauschii* van Keppel (1969).

[12] Stem sparsely branching, usually < 10 cm long, ± 1 cm Ø; **L** in a compact **Ros**, narrowly obovate-oblong, acute, 3 - 5 × 0.8 - 2 cm, smooth, dark green to brownish-green, often red-margined; **Inf** racemose, lower **Br** often 2-flowered; **Ped** drooping, to 2 cm or more; **Sep** appressed or slightly

spreading, to 6 mm, linear-lanceolate, acute; **Cl** urceolate-pentagonal, 10 - 15 mm long, yellowish-red to coral. – *Cytology*: $n = \pm 96$.

E. wurdackii Hutchison ex Kimnach (Haseltonia 9: [in press], ill., 2002). **T:** Peru, Amazonas (*Wurdack* 1163 [UC]). – **D:** Peru (Amazonas).

[12] Stem to 10 - 20 cm long, sprawling in shade, 1 - 1.3 cm Ø; **Ros** laxly diffuse, sparsely offsetting, 12 - 15 cm Ø; **L** obovate, subobtusate, minutely mucronate, 5 - 9 cm long, 3 - 4 cm wide near the tip, 2 - 4 mm thick, green, lightly glaucous; **Inf** racemose but with the **Ped** directed towards the light, 15 - 20 cm long, 6 mm Ø near the base, with ± 5 - 15 **Fl**; **Ped** horizontal-recurving during anthesis, ± 3 cm, 2.5 - 3 mm Ø; **Sep** expanding, 5 - 8 mm; **Cl** turbinate, 13 - 15 mm long, 8 mm Ø near the base, opening ± 4 mm, yellow near apex, otherwise uniformly orange.

Differs from *E. utcubambensis* in its long pedicels and more diffuse rosettes of larger leaves.

×GRAPSONELLA

U. Eggli

×**Grapsonella** G. D. Rowley (Name that Succulent, 152, 1980).

= *Graptopetalum* × *Thompsonella*. See Uhl (1994b) for a list of known hybrid combinations (none formally named).

×GRAPTOLADIA

U. Eggli

×**Graptoladia** C. H. Uhl (CSJA 66(5): 216, 1994).

= *Graptopetalum* × *Villadia*. See Uhl (1994c) for a list of known hybrid combinations (none formally named).

GRAPTOPETALUM

J. Thiede

Graptopetalum Rose (CUSNH 13(9): 296, 1911). **T:** *Graptopetalum pusillum* Rose [Typification by inference, only element included.]. – **D:** USA (C and S Arizona), Mexico (widespread from Sonora and Chihuahua to Oaxaca); rocky places, to 2400 m. **Etym:** Gr. 'graptos', inscribed, marked; and Gr. 'petalon', petal; for the usually spotted or blotched petals.

Incl. *Byrnesia* Rose (1922). **T:** *Byrnesia weinbergii* Rose [Typification by inference, only element included.].

Incl. *Tacitus* Moran (1974). **T:** *Tacitus bellus* Moran & J. Meyrán.

Incl. ×*Tacipetalum* C. H. Uhl (1995).

Perennial **Ros** plants; **R** mostly fibrous; stems mostly smooth, either short and plants ± mat-form-

ing, or forming $\pm$ woody shrublets, $\pm$ branched, erect (to decumbent or pendent), 15 - 40 (-200) $\times$ 0.2 - 1.3 (-2) cm; **L** mostly $\pm$ dense in **Ros** of (2-) 3 - 8 (-16) cm $\varnothing$ at the **Br** tips, young often $\pm$ ascending, later spreading and often $\pm$ recurved, usually $\pm$ obovate to $\pm$ (broadly) spatulate, to 7 $\times$ 4 cm, mostly $\pm$ glaucous-pruinose, upper face mostly $\pm$ flat, rarely weakly convex oder slightly concave-canaliculate, lower face mostly $\pm$ clearly convex-rounded, often $\pm$ keeled, apically pointed to rounded, usually with a 0.5 - 3 (-12) mm long mucronate-aristate tip; **Inf** mostly several between the **Ros** leaves, rarely from below the **Ros**, normally $\pm$ ascending, (2-) 4 - 15 (-60) cm, with **L**-like **Bra**; **Inf** thyrses with few to numerous scorpioid **Br** with (1-) 2 - 10 (-15) **Fl**, uppermost **Bra** few- or mostly 1-flowered, scorpioid **Br** not coiled (sometimes coiled in *G. rusbyi*), or **Inf** cymose with 1 - 5 scorpioid **Br** with 1 - 5 **Fl**; **Ped** (1-) 5 - 25 mm; **Fl** erect, usually 5-merous (rarely 4- or 7- to 10-merous), open for 4 - 14 days; **Cal** cup- (to bowl-) shaped; **Sep** appressed (recurved in *G. bellum*), usually free to the base, mostly almost equal; **Cl** opening stellately, 11 - 21 (-38) mm $\varnothing$; **Pet** basically whitish or yellowish (to greenish), usually with reddish to brown cross-band markings or blotches, these denser towards the tips and often confluent, rarely only a little blotched or uniformly coloured whitish or rose-red, basally slightly united, **Cl** tube campanulate, bowl- or cup-shaped, sometimes (generally?) angled; **St** in 2 series (only 1 series in the *G. pentandrum* group), first erect and then dehiscing, later spreading and episeal **St** recurved between the **Pet**, after anthesis becoming (always?) erect again; episeal **Fl** basally radially widened, hardly to conspicuously united with the **Cl** and intercarpellar tissue, epipetal **Fl** basally tangentially widened, conspicuously united with the **Cl**; **NSc** ascending, $\pm$ square to $\pm$ reniform, normally whitish to $\pm$ yellowish; **Ca** $\pm$ (narrowly) obovate to elliptic, whitish, yellowish, greenish or reddish, apically partly red to rose, basally fused for 0.5 - 2 (-3) mm, with numerous ovules; **Sty** normally abruptly offset; **Fr** ascending to erect; **Se** reddish-brown, $\pm$ cylindrical, $\pm$ 0.6 - 0.7 $\times$ 0.2 - 0.3 mm, normally reticulate. – *Cytology*: very variable, $n = 30, 31, 32, 34, 35, 62, 64, 66, 68, \pm 93, 170 \pm 5, 175 \pm 2, 192, \pm 193, \pm 204, 208 \pm 3, 244 \pm 4, 245 \pm 5, 270 \pm 5$.

The genus is characterized esp. by the stamens which become recurved during anthesis, as well as by the mostly at least in part spotted to striped petals (weakly spotted or plain in *G. paraguayense* ssp. *bernalense*, plain in *G. bellum* and *G. mendozae*), the stellately opening flowers and the scorpioid inflorescence branches that are not coiled (partly coiled in *G. rusbyi*). Some taxa previously here classified (*G. goldii*, *G. craigii* and *G. suaveolens*) belong to *Sedum*.

Graptopetalum appears to be closest to *Sedum* Sect. *Pachysedum* with similar (but free) rotate co-

rollas. Many species of Sect. *Pachysedum* exhibit similar chromosome numbers (Uhl 1978), and in some species, the stamens curve outwards after anther dehiscence in a similar manner. A revision of the genus has been finished by R. Moran, where *Graptopetalum* is classified into 7 sections that are almost identical to the species groups proposed here. The only exception (apart from treating *Tacitus* as a separate genus) is *G. macedougallii* for which a section of its own is created (here placed in the *G. pusillum* group).

Intergeneric hybrids are known with the following genera: *Echeveria* (= $\times$ *Graptoveria*), *Lenophyllum* (= $\times$ *Lenaptophyllum*), *Pachyphytum* (= $\times$ *Graptophytum*), *Sedum* (= $\times$ *Graptosedum*), *Thompsonella* (= $\times$ *Grapsonella*), *Villadia* (= $\times$ *Graptoladia*).

Graptopetalum can be subdivided as follows:

- [1] Sect. *Byrnesia* (Rose) Moran 1984: Shrublets with $\pm$ woody stems; **L** tips usually at the most pointed but without conspicuous mucro; **L** scar much narrower than the **L** base, mostly with only 1 **L** trace (3 in *G. amethystinum*); dry **L** caducous. Species esp. from C and S Mexico.
 - [1a] *G. paraguayense* Group: Stems elongate, not strictly erect, later usually $\pm$ decumbent; **L** normally flushed rose-red to lavender; **Fl** predominantly in spring. – Possibly a paraphyletic hold-all for the least specialized species.
 - [1b] *G. pentandrum* Group: Habit similar to [1a] but **Fl** haplostemonous; **Fl** and **Ca** $\pm$ yellowish and apically reddened.
 - [1c] *G. fruticosum* Group: Branched shrublets with erect stems; **Inf** from below the **Ros** and first similar to vegetative **Br**; **Fl** predominantly in spring; episeal **Fl** fused with the **Cl** and intercarpellar tissue and thus forming 5 conspicuous nectar pouches.
 - [1d] *G. pachyphyllum* Group: Stems short and plants mat-forming; **Inf** from amongst the **Ros** leaves; **L** $\pm$ rounded, not flattened and broadened; **Bra** similar to the **Ros** leaves, sometimes even somewhat larger; **Fl** in summer.
- [2] Sect. *Graptopetalum*: Often mat-forming **Ros** plants with short stems, stems hardly or not woody; **Inf** always from among the **Ros** leaves; **L** tips usually with a conspicuous $\pm$ elongate mucro; **L** fused to the axis with broad base, **L** scar with several **L** traces (always?); dry **L** persistent for some time. Species from the S USA and NW to W-C Mexico.
 - [2a] *G. pusillum* Group: Main **R** mostly not thickened; **Sty** abruptly narrowed, $\pm$ 0.5 mm; **L** smooth; **Fl** in autumn or winter.
 - [2b] *G. filiferum* Group: Main **R** markedly thickened; **Sty** slowly narrowing, ≥ 1 (-4.5) mm; **L** tip papillose (generally?); **Fl** predominantly in spring.

G. amethystinum (Rose) E. Walther (CSJA 3(4): 73-75, ill., 1931). **T:** Mexico, Jalisco (*Rose* 2993 [US, NY]). – **D:** Mexico (Durango, Jalisco, Sinaloa); 1950 m. **I:** KuaS 43: 133, 1992; KuaS 48: centre page pullout 24, 1997. **Fig. XVI.a**

≡ *Pachyphytum amethystinum* Rose (1905) ≡ *Echeveria amethystina* (Rose) hort. ex von Poellnitz (1936) (*nom. inval.*, Art. 34.1c).

[1a] Shrublets; stems erect to decumbent-pendent, sometimes basally branched, to 30 cm; **Ros** 10 - 15 cm Ø, with 12 - 15 **L**; **L** obovate, apically rounded, 3 - 7 × 2.5 - 4 cm, 10 - 18 mm thick, first rose-coloured, later grey, glaucous-pruinose, with 3 **L** traces; **Inf** 5 - 15 cm, ascending to curved downwards, thyrses with 7 - 65 **Fl**, axis zigzag, 4 - 11 cm, with 3 - 10 scorpioid **Br** with up to 6 **Fl**; **Fl** 5-merous; **Ped** 5 - 8 mm; **Cal** 5 - 6 mm Ø; **Sep** ovate, acute, almost equal, 2.5 - 4 × 1.5 - 3 mm; **Cl** 15 - 18 mm Ø; **Pet** 10 - 11 mm, pale whitish-yellow to pale yellow, tube campanulate, 3.5 - 4 × 5 - 6 mm, lobes triangular-lanceolate, acute, 6 - 7 × 3 - 3.5 mm, upper face with red cross-bands, apically almost entirely red; **Fil** 8 - 10 mm, fused with the **Cl** tube for 3 - 4.5 mm, pale yellow; **NSc** bluntly lunate, 0.4 - 0.5 × 1 mm, white or yellowish; **Ca** hollowed above the **NSc**, 6 × 1.5 mm, basally fused for 1 mm, pale white-yellowish; **Sty** abruptly offset, ± 1 mm. – *Cytology*: n = 34, 35.

G. bartramii Rose (Addisonia 11(1): 1-2, pl. 353, 1926). **T:** USA, Arizona (*Bartram* s.n. [US, NY]). – **D:** USA (C and S Arizona), Mexico (Chihuahua); rocky places, 1200 - 2000 m. **I:** Desert Pl. Life 21: 54-55, 1949.

≡ *Echeveria bartramii* (Rose) Kearney & Peebles (1939).

[2a] **Ros** plants, usually forming mats; main **R** thickened; stems short; **Ros** dense, with ≥ 20 **L**; **L** ovate to broadly spatulate, apically pointed, flat or upper face somewhat concave, 2.5 - 6.25 cm, bluish-green, margins and tip reddish; **Inf** 2 - 7 from amongst the inner **Ros** leaves, 20 - 30 cm, racemes or mostly thyrses with few scorpioid **Br** with up to 3 **Fl** each; **Ped** short; **Fl** 5-merous, evil-scented or without scent; **Sep** narrowly triangular to oblong-lanceolate, ± acute, small, 5 mm; **Cl** 16 - 28 mm Ø; **Pet** narrow, 8 - 15 mm, whitish, tube somewhat shorter than the **Sep**, lobes acute, esp. the upper ½ with red or brown spots and/or bands; **Fil** short, inserted at the mouth of the **Cl** tube; **Ca** dorsally hollowed above the **NSc**; **Sty** abruptly narrowed, very short. – *Cytology*: n = 31.

G. bellum (Moran & J. Meyrán) D. R. Hunt (CBM 182(4): 130, t. 781, 1979). **T:** Mexico, Chihuahua (*Lau* s.n. in *Moran* 21217 [SD, ENCB, HNT, ME-XU]). – **D:** Mexico (Chihuahua); E-exposed rocks, 1600 m; only known from the type locality. **I:** Moran & Meyrán (1974). **Fig. XVI.b**

≡ *Tacitus bellus* Moran & J. Meyrán (1974).

[2b] **Ros** plants; main **R** thickened, to 4 mm Ø; stems short; **Ros** flat and densely leafy, 3 - 8 cm Ø, with ± 25 - 30 **L**, solitary or forming groups; **L** obovate to cuneate, broadly obtuse to rounded, 2 - 3.5 × 1.5 - 2.8 cm, 4 - 5 mm thick, mostly dark or greyish-green, mucro 2 mm and somewhat papillose; **Inf** erect thyrses with 1 - 4 ascending scorpioid **Br** with up to 3 **Fl** each, scape 1.5 - 3.5 cm, green; **Ped** 10 - 25 mm; **Fl** (rarely 4- or) 5-merous, (almost) unscented; **Sep** elliptic to oblong, acute, almost equal, recurved towards the end of the anthesis, 6 - 11 × 2 - 4 mm, pale green; **Cl** (23-) 30 - 38 mm Ø; **Pet** elliptic-acute, ± deep rose-coloured, tube cup-shaped, 3 - 4 × 4 - 6 mm, lobes elliptic-ovate, acute, margins entire or finely denticulate in the middle, 11 - 18 × 6 - 10 mm, without pattern, basally with 2 rounded outgrowths that close the mouth of the tube and embrace the epipetal **Fil**; **Fil** 7 - 11 mm, basally fused with the **Cl** tube for 3 - 4 mm, rose-coloured; **NSc** erect, apically truncate, ± 0.35 × 1 mm, whitish; **Ca** dorsally keeled and except for the base with 2 furrows, basally almost free, 10 - 15 × 2.25 mm, intensely red; **Sty** gradually narrowed, 2.5 - 4.5 mm. – *Cytology*: n = ± 204.

As the differences given by Moran & Meyrán (1974) between *Tacitus* and *Graptopetalum* are partly unfounded, partly quantitative only, and as *G. bellum* can be placed in *Graptopetalum* without difficulties (where it forms a well-characterized group together with *G. rusbyi* and *G. filiferum*), a separate genus *Tacitus* appears unwarranted. The differences in flower morphology and colour are probably associated with a change in pollinator (*G. bellum*: probably hummingbirds; other species: presumably flies), as already pointed out by Moran & Meyrán (l.c.).

G. filiferum (S. Watson) J. Whitehead (CSJA 15: 69-71, ills., 1943). **T:** Mexico, Chihuahua (*Palmer* s.n. [not located]). – **D:** Mexico (Chihuahua); on rocks, around 2150 m. **I:** Eggli (1994: 216). **Fig. XVI.d**

≡ *Sedum filiferum* S. Watson (1885).

[2b] **Ros** plants; stems short; **Ros** flattened, dense, to 5 - 6 cm Ø (often less), with 75 - 100 **L**, mat-forming; **L** spreading, long-pointed, 2 - 3 × 0.8 - 1.2 cm, 2 - 4 mm thick, bright green, margins hyaline, apical margin finely papillose, **L** tip with **Ha**-like aristate mucro, this 5 - 12 mm, becoming brown; **Inf** up to 6, thyrses with 2 - 4 scorpioid unilateral **Br** with up to 5 **Fl** each, between the innermost **Ros** leaves, scapes 4 - 8 cm, pale green; **Ped** 10 - 15 mm; **Fl** 5- to 6- (to 7-) merous; **Sep** basally somewhat fused, obovate, blunt but mucronate, very delicately papillose, almost equal, 4 - 5 mm, reddish-green; **Cl** ± 2 cm Ø; **Pet** lanceolate, 10 - 12 mm, white, tube 4 - 5 mm, lobes acute, apically with bright dark brown-red blotches; **Fil** ± 6.5 mm, episeal **Fil** longer, epipetal **Fil** fused with the **Cl** for ± 4 mm; **NSc** reniform, yellow; **Ca** long-lanceo-

late, conspicuously 4-angled, ± 7 mm, basally fused for ± 2.3 mm, pale green or white; **Sty** abruptly narrowed, white. – *Cytology*: $n = 31, 32$.

Distinguished from all other species by the leaves with long hair-like tips.

G. fruticosum Moran (CSJA 40(3): 152-156, ill.; 41(1): 19 [erratum, 1969], 1968). **T**: Mexico, Jalisco (*Moore & Bunting* 8728a [SD 67046, BH, CH, DS, HNT, K, MICH, NY, UC, US]). – **D**: Mexico (Jalisco); on rocks, $\pm 1050 - 1200$ m. **I**: KuaS 43: 131, 1992. **Fig. XVI.c**

[1c] Shrublets; stems papillose, basally branched, to 40 cm, 0.25 - 0.8 cm $\varnothing$; **Ros** lax, 3 - 7 cm $\varnothing$, with 20 - 30 **L** scattered over 2.5 - 10 cm; **L** spatulate to rhombic-spatulate, elongate or rounded, weakly mucronate, 2 - 4 $\times$ 0.8 - 2 cm, 2.5 - 4 mm thick, pale green or reddish, somewhat glaucous; **Inf** 3 - 14 cm below the **Br** tips, 12 - 30 cm, glaucous-pruinose, thyrses with $\pm 12 - 50$ **Fl**, axis somewhat zigzag, 5 - 14 cm, with 5 - 11 scorpioid **Br** with 0 - 3 secondary **Br**; **Fl** 5- (to 6-) merous; **Ped** 5 - 18 mm; **Cal** cup-shaped, 3 - 5 $\times$ 3 - 6 mm; **Sep** appressed, almost free, triangular to oblong, acute, somewhat unequal, 2 - 4.5 $\times$ 1 - 1.5 mm; **Cl** 16 - 21 mm $\varnothing$; **Pet** triangular-lanceolate, 7 - 9 $\times$ 2 - 3 mm, pale yellow or yellowish-white, tube campanulate, 3 - 3.5 $\times$ 3.5 - 5.5 mm, lobes acute, with cardinal-red stripes $\pm$ confluent towards the tip; **Fil** 6 - 8 mm, fused with the **Cl** for 2.5 - 3 mm, episepal **Fil** basally radially widened, fused with the **Cl** and intercarpellar tissue and thus forming 5 conspicuous nectar pouches, yellowish-green, $\pm$ marked with red; **NSc** basally slender, truncate, 0.4 - 0.5 $\times$ 0.7 - 0.9 mm, whitish to orange-yellow; **Ca** 5 - 6 mm, fused basally for ± 2 mm, reddish; **Sty** abruptly narrowed, somewhat reclined, 0.6 - 0.7 mm. – *Cytology*: $n = 31$.

Most closely related to *G. grande* according to the protologue. The original type citation has been corrected in the erratum.

G. grande Alexander (CSJA 28(6): 174-176, ill., 1956). **T**: Mexico, Oaxaca (*MacDougall* B.155 [NY]). – **D**: Mexico (Guerrero, Oaxaca); partly shaded rocks and cliffs, 1500 - 2000 m. **Fig. XVII.a**

[1c] Shrublets; stems erect, to 30 (-200) cm, to 1.5 cm $\varnothing$, grey-green; **L** spreading, rather laxly arranged, broadly spatulate, apically truncate or somewhat obtuse, 5 - 8.5 $\times$ 3.5 cm, pale yellow-green; **Inf** few, to 35 cm, thyrses 6 - 22 cm, with 6 - 9 spreading scorpioid $\pm$ zigzag **Br** with 0 - 4 secondary **Br** with ± 4 **Fl** each; **Fl** 5-merous; **Ped** 5 - 8 mm; **Sep** linear, unequal, 2.5 - 3 mm; **Cl** 20 mm $\varnothing$; **Pet** lanceolate, 11 mm, upper face sulphur-yellow, lower face pale green, tube 2 mm, markedly saccate, lobes keeled on the lower face, with basally scattered chestnut-brown blotches and/or stripes that become confluent apically, lower face with red stripes near the margins; epipetal **Fil** fused with the

Cl, episepal filaments basally widened radially, fused with the **Cl** and intercarpellar tissue and thus forming 5 conspicuous nectar pouches, greenish-white; **NSc** falcate, 1 $\times$ 1.2 mm, bright orange; **Ca** semi-obovate, 6 mm, basally fused for < 3 mm; **Sty** abruptly narrowed, somewhat reclining, ± 1 mm, orange-red. – *Cytology*: $n = 66$.

G. macdougallii Alexander (CSJA 12: 161-163, ill., 1940). **T**: Mexico, Oaxaca (*MacDougall* s.n. [NY]). – **D**: Mexico (Oaxaca); on somewhat shady rocks, rarely epiphytic, 1200 - 2100 m. **I**: KuaS 48: centre-page pullout 97/20, 1997. **Fig. XVI.e**

[2a] **Ros** plants; stems short, basally branched and in addition with axillary runners; **Ros** dense, $\pm$ mat-forming; **L** tongue-shaped, spreading during the growth season, connivent during the dry season, 2.5 - 3.5 $\times$ 0.8 - 1.5 cm, usually $\pm$ bright bluish to greenish, apically drawn out into an up to 2 mm long elongate tip; **Inf** 5.5 - 7 cm, thyrses $\pm 1.5 - 3$ cm, with scorpioid pendent **Br** with up to 10 **Fl** in total; **Fl** 5-merous, **Ped** to 2 cm; **Sep** basally united, obovate, acute, 6 - 8 mm; **Pet** ovate-lanceolate, pointed, 7 - 10 mm, lower face green, tube 3 - 4 mm, inside whitish-yellow-green, lobes with basally scattered brown blotches and/or stripes, these confluent in the middle and resulting in an almost solid coloration towards the tips, apically yellowish-green, lower face with red stripes near the margins; **Fil** 5 - 8 mm, epipetal **Fil** fused with the **Cl** for 1.5 - 4 mm, greenish-white, apically tinged reddish; **NSc** $\pm 0.6 \times 0.9$ mm, dull yellow-brown; **Ca** obliquely semi-ovate, somewhat keeled, 6 - 7 mm, basally fused for ± 3 mm; **Sty** abruptly narrowed, almost erect, flesh-coloured. – *Cytology*: $n = 64 - 66, 192, 244 \pm 4, 245 \pm 5$.

The size of the nectary scales as given in the protologue (1 $\times$ 1.5 - 1.8 mm) is not supported by the material available for study. The species is geographically isolated within Sect. *Graptopetalum*, as all other species of the section are located between Nayarit/Durango and Arizona.

G. marginatum Kimnach & Moran (*Haseltonia* 8: [in press], ill., 2002). **T**: Mexico, Nayarit (*Ullrich* s.n. [HNT, MEXU, US]). – **D**: Mexico (Nayarit); steep rocky cliffs in (sub-) deciduous forest, 670 m, known only from the type locality.

[2a] **Ros** usually solitary, with short stem 3 $\times$ 1 - 2 cm, **Ros** semiglobose, (6-) 10 - 14 cm $\varnothing$; **L** 12 - 25, young ascending, later horizontal to recurving, obovate-spatulate, oldest **L** (4-) 5 - 6.5 $\times$ 2 - 3 cm, 3 - 4 mm thick, with white acuminate acute mucro 1.5 - 2 mm long, lamina greyish-green or reddish in strong light, with faint waxy bloom, epidermis with protruding cells but smooth to the touch, margins sharp, somewhat membranous, conspicuously whitish; **Inf** 1 - 4, (12-) 20 - 30 (-40) cm, ascending to horizontal, scape 4 - 9 cm, with (5-) 10 - 14 scorpioid (rarely bifurcate) zig-zag **Br** with (2-) 5 - 6 **Fl**

each; **Fl** with musty scent; **Ped** 10 - 15 mm; **Sep** acute, basally fused for 0.75 mm, $3 - 5 \times \pm 1$ mm, glaucous-green; **Pet** deltoid-acuminate, acute, $\pm 10 \times 3$ mm, greenish-cream, apical $\frac{1}{2}$ deeply grooved, with spots and lateral parallel brownish-red bands, basal $\frac{1}{2}$ with less frequent spots; **Fil** ± 8 mm, flattened-linear; **Ca** turbinate; **Sty** subulate, acute, ± 0.75 mm.

A very distinct recent discovery, esp. because of its flat and typically solitary rosettes with white-margined leaves. *G. marginatum* is the first record of the genus from Nayarit. It appears to be without close relatives but is most similar to *G. bartramii*.

G. mendozae Glass & Cházaro (Cact. Suc. Mex. 42(4): 79-82, ill. [incl. back cover], 1997). **T:** Mexico, Veracruz (*Mendoza Garcia & Sierra Pichardo* 288 [XAL, CANTE, CHAPA, ENCB, IEB, IBUG, MEXU, MICH, NY, WIS]). – **D:** Mexico (N Veracruz); volcanic cones, 100 - 200 m. **I:** KuaS 52: centre page pullout 8, 2000.

[1a] Perennial group-forming shrublets; stems erect to pendent or decumbent, 10 - 15 $\times$ 0.4 cm, cream-coloured to green-greyish, with conspicuous **L** scars 4 - 8 mm distant; **Ros** to 3.5 cm $\varnothing$, with 12 - 17 **L**; **L** obovate, upper face flat to slightly convex, lower face convex, apically bluntly obtuse, to 18 $\times$ 11 mm, basal **L** largest, diminishing in size upwards, grey; **Inf** 8 - 9 cm (scape 3 - 6 cm), 1 - 2 per plant; **Inf** with 2 cincinni and a total of 4 - 10 **Fl**; **Bra** 6, to 7 mm, caducous; **Ped** 1 - 2 cm; **Cal** $\pm 3 \times 5$ mm; **Sep** appressed; **Cl** ± 8 (closed) $\times$ 10 - 12 mm; **Pet** triangular-ovate, 4 - 5 $\times$ 2.5 - 3 mm, pure white, tube 3 - 4 $\times$ ± 5 mm, lobes acute, without pattern; **Fil** white; **Sty** 0.5 - 1 mm. – *Cytology*: $n = 34$.

According to the protologue most closely related to the geographically close *G. paraguayense* ssp. *bernalense*. Main differences are the smaller size of plants and rosettes, a different leaf shape and inflorescence length, unicoloured petals and a different chromosome number.

G. occidentale Rose ex E. Walther (CSJA 5(1): 411, ill., 1933). **T:** Mexico, Sinaloa (*Gonzalez Ortega* 3019 [US 1014184, K, NY]). – **D:** Mexico (Sinaloa); only known from the type collection. **I:** CSJA 56: 175, 1984.

[2a] **Ros** plants; main **R** somewhat thickened; stems erect, short; **Ros** $\pm 2 - 2.5$ cm $\varnothing$, with ± 25 **L**, mat-forming; **L** obovate to spatulate or somewhat rhombic, 1 - 1.6 $\times$ 0.7 cm, occasionally somewhat bluish, obtuse and long-pointed, mucro 1 - 3 mm, upper **L** margins and mucro inconspicuously papillose; **Inf** ± 15 cm, openly cymose with 2 semi-erect unilateral ± 8 cm long scorpioid **Br** with 5 - 6 **Fl**, scape slender, $\pm$ violet; **Ped** 4 - 8 mm; **Fl** 5-merous; **Sep** free, ovate to lanceolate, 2.5 - 3.5 $\times$ ± 1 mm; **Pet** 7 - 8.5 $\times$ 1.5 - 2 mm, tube 1.5 - 2 mm, lobes spotted, background colour unknown; **Fil** ± 5 mm,

epipetal **Fil** fused with the **Cl** for 1.5 - 2 mm; **Ca** 4 - 5.5 mm, basally attenuate to ± 1 mm and fused for ± 2 mm; **Sty** abruptly narrowed, very noticeable, to 0.5 mm.

A little-known species. Material from Sonora and the coast of Sinaloa previously identified as *G. occidentale* properly belongs to *G. rusbyi*.

G. pachyphyllum Rose (Addisonia 7(3): 45, pl. 247, 1922). **T:** Mexico, Querétaro (*Rose & al.* 9730 [US, B, MEXU, NY]). – **D:** Mexico (Guanajuato, Hidalgo, Jalisco, Querétaro, San Luis Potosí, Zacatecas); shady rocks and cliffs, 1900 - 2300 m. **I:** Moran (1990); KuaS 51: 11-12, 2000.

Incl. *Sedum atypicum* A. Berger (1930); **incl.** *Echeveria minutifoliata* von Poellnitz (1935).

[1d] Shrublets; stems erect, to 7 cm or decumbent to 20 cm, bluish-green, later becoming brown; **Ros** 1.5 - 4.5 cm, with 15 - 50 congested **L**, often mat-forming; **L** clavate to oblanceolate or -spatulate, obtuse to broadly pointed, apically mostly papillose and mucronate, 0.8 - 1.5 (-2.2) $\times$ 0.4 - 0.7 (-1.1) cm, 2 - 4 (-6) mm thick, $\pm$ glaucous-pruinose, tip often dark red; **Inf** 2 - 10 cm, lax thyrses with 1 - ≥ 4 scorpioid **Br** with up to 5 **Fl** each; **Bra** in shape and size $\pm$ like the **Ros** leaves; **Fl** 5-merous; **Ped** 5 - 25 (-40) mm; **Sep** appressed or somewhat patent, oblong, acute, $\pm$ unequal, 2 - 8 $\times$ 1 - 2.5 mm; **Cl** 11 - 23 mm $\varnothing$; **Pet** triangular-lanceolate, 6 - 10 $\times$ 2.5 - 4.5 mm, greenish-whitish, tube 3 - 5 $\times$ 4 - 7 mm, lobes acute, weakly red-spotted or with 3 - 7 inconspicuous stripes; **Fil** 6 - 10 mm, epipetal **Fil** fused with the **Cl** for 3 - 4 mm; **NSc** 0.6 - 0.7 $\times$ 0.9 - 1 mm, yellow; **Ca** semi-ovoid, dorsally rounded, 6 - 9 mm, basally fused for 2 - 3 mm, basally greenish or whitish, above rose-coloured; **Sty** abruptly narrowed, almost erect, 0.6 - 0.8 mm. – *Cytology*: $n = 30, 170 \pm 5, 175 \pm 2, \pm 193, 208 \pm 3, 270 \pm 5$.

This is the only summer-flowering species apart from *G. saxifragoides*, which appears to be closely related (Moran 1990).

G. paraguayense (N. E. Brown) E. Walther (CSJA 9: 108, 1938). **T:** Ex cult. (*Rose* 07.575 [K, US]). – **Lit:** Kimmach & Moran (1986). **D:** Mexico.

$\equiv$ *Cotyledon paraguayensis* N. E. Brown (1914) $\equiv$ *Echeveria paraguayensis* (N. E. Brown) hort. ex von Poellnitz (1936) (*nom. inval.*, Art. 33.3) $\equiv$ *Sedum paraguayense* (N. E. Brown) Bullock (1937).

G. paraguayense ssp. *bernalense* Kimmach & Moran (CSJA 58(2): 54, ill., 1986). **T:** Mexico, Tamaulipas (*Lau* 89 [HNT, BH, MEXU, SD, US]). – **D:** Mexico (Tamaulipas); N-exposed porphyric rocks, 700 - 800 m; only known from the type locality. **I:** KuaS 43: 133, 1992.

$\equiv$ *Byrnesia bernalensis* (Kimmach & Moran) P. V. Heath (1994).

[1a] Differs from ssp. *paraguayense*: Smaller in all parts; stems 5 - 6 mm $\varnothing$; **Ros** 2.5 - 6 cm $\varnothing$; **L** 2.5

- 3.5 × 1 - 1.6 cm, yellowish or greenish-cream; **Cl** 11 - 15 mm Ø; **Pet** 2.5 - 3 mm broad, tube 2.5 - 3 mm broad, lobes pure white or upper face with 1 - 2 faint blotches near the margins. - *Cytology*: n = 68.

A related but much smaller and more offsetting species from N Veracruz was recently described as *G. mendozae*.

G. paraguayense ssp. **paraguayense** - **D**: Only known from cultivation, probably E-C Mexico; neophytic in Australia (Queensland). **I**: CSJA 58: 48-56, 1986.

Incl. *Echeveria weinbergii* hort. ex T. B. Shepherd (1912) ≡ *Byrnesia weinbergii* (T. B. Shepherd) Rose (1922) ≡ *Graptopetalum weinbergii* (T. B. Shepherd) E. Walther (1930) ≡ *Sedum weinbergii* (T. B. Shepherd) A. Berger (1930); **incl.** *Echeveria arizonica* hort. ex Rose (1922); **incl.** *Graptopetalum byrnesia* E. Walther (1931) ≡ *Echeveria byrnesia* (E. Walther) hort. ex Rooksby (1933).

[1a] Shrublets; stems decumbent or pendent, only basally branched, to ≥ 30 cm, 8 - 12 mm Ø; **Ros** lax, 7 - 12 (-16) cm Ø, with 15 - 25 (-30) **L** scattered over 4 - 8 cm; **L** spreading to somewhat recurved, cuneate to obovate, shortly pointed, 4 - 7 (-8) × 1.5 - 3 (-4) cm, 7 - 10 mm thick, ± rose-coloured, later mostly lavender; **Inf** mostly 1 - 2 cm below the **Br** tip, usually 1 or 2 per **Ros**, 8 - 22 cm, ± rose-coloured, thyrses 3 - 12 cm, with 2 - 4 (-6) mostly simple or 2× furcate scorpioid **Br** with 5 - 15 **Fl**; **Fl** 5-merous; **Ped** 4 - 16 mm; **Cal** 3 - 5 × 4 - 8 mm; **Sep** triangular-ovate, acute, almost equal, 1.3 - 3 mm broad; **Cl** 13 - 19 mm Ø; **Pet** triangular-ovate, 6 - 8 × 3 - 4.5 mm, white, tube 4 - 5 × 5 - 7 mm, lobes acute, with small scattered red spots; **Fil** 7 - 9 mm, epipetal **Fil** fused with the **Cl** for ± 3 - 4 mm, episepal **Fil** basally widened radially to ± 1 mm, white; **NSc** erect, square, 0.6 - 1 × 0.6 - 1 mm, yellow; **Ca** 6 - 9 mm, dorsally somewhat keeled, basally fused for ± 1 mm, yellowish-green or somewhat reddish; **Sty** gradually narrowed, erect, 0.5 - 1 mm. - *Cytology*: n = 68.

Apparently closest to *G. amethystinum* (Kimnach & Moran 1986). The same authors explain the complicated history of the species. The flower drawings they give erroneously show only a very short basal fusion of the filaments with the corolla.

G. pentandrum Moran (CSJA 43(6): 255-258, ill., 1971). **T**: Mexico, Jalisco (*Boutin & Kimnach* 2922 [SD 79372, HNT]). - **D**: Mexico (Michoacán, Jalisco).

G. pentandrum ssp. **pentandrum** - **D**: Mexico (Michoacán); shady rock cliffs, 1200 m. **Fig. XVI.f**

[1b] Shrublets; stems first erect, later ± decumbent, stiff, strongly woody, branched predominantly from the base, to 15 × 0.3 - 0.6 cm, dull green, strongly glaucous; **Ros** lax, 6 - 8 cm Ø, with 12 - 35

L scattered over 1 - 9 cm; **L** spreading to somewhat recurved, mostly obovate, cuneate, obtuse to rounded with an inconspicuous mucro, 2 - 4 (-5.5) × 1.5 - 2.3 cm, 5 - 8 mm thick, first bluish-glaucous-pruinose, later yellowish-grey, mostly ± with a lavender hue; **Inf** spreading, from 2 - 8 cm below the **Br** tips, 20 - 35 cm, slender, thyrses 12 - 20 cm with 3 - 4 spreading simple or 2× furcate slender scorpioid 10 - 15 cm long **Br** with 7 - 10 **Fl** each; **Fl** 5-merous; **Ped** 17 - 23 mm; **Cal** cup-shaped, 4 - 4.5 × 4.5 - 5 mm, glaucous-pruinose; **Sep** appressed, narrowly ovate, ± acute, almost equal, 3.5 - 4 × 1.5 mm; **Cl** 17 - 18 mm Ø; **Pet** 5 - 7 × 1.75 - 2.75 mm, yellowish-white, tube 3 - 3.5 × 4 mm, lobes triangular, acute, basally with a continuous dark red stripe, upper ½ almost completely dark red; only the 5 episepal **St** present; **Fil** 8 mm, basally fused with the **Cl** for 3 mm, greenish, upper ½ red-patterned; **NSc** ± obtusely lunate, basally attenuate, above truncate, 0.4 × 0.9 mm, bright yellow; **Ca** 7 - 7.5 mm, dorsally sharply keeled, basally fused for 2.5 mm, greenish, apically somewhat red; **Sty** abruptly narrowed, somewhat reclining, hardly 1 mm. - *Cytology*: n = 32.

Distinguished from all other species by having only 5 stamens as well as long slender inflorescence branches and pedicels. It appears to be most closely related to *G. amethystinum* and *G. paraguayense* according to the protologue. Both subspecies of *G. pentandrum* were initially described on the base of cultivated material and were only later found in the wild. A related and strongly offsetting species from gypsum slopes in Colima does also have only 5 stamens and will be formally described in the near future by Acevedo Rosas & Cházaro.

G. pentandrum ssp. **superbum** Kimnach (CSJA 59(4): 140-143, ill., 1987). **T**: Mexico, Jalisco (*Avina* s.n. [HNT, BH, MEXU, US]). - **D**: Mexico (Jalisco); 1200 m. **Fig. XVII.b**

[1b] Differs from ssp. *superbum*: Stems 10 - 12 mm Ø; **Ros** with 12 - 20 scattered **L**; **L** 4 - 5.5 × 2 - 2.5 cm, greenish-violet; **Inf** 30 - 40 cm with 12 - 15 **Br**; **Ped** 10 - 14 mm; **Cl** 15 - 16 mm Ø; **Pet** basally greenish, lobes with numerous red speckles. - *Cytology*: n = 64.

This taxon will be elevated to species rank in a future paper by Acevedo Rosas.

G. pusillum Rose (CUSNH 13(9): 296, pl. 52, fig. 55, 1911). **T**: Mexico, Durango (*Palmer* s.n. [US 615399]). - **D**: Mexico (Durango). **I**: KuaS 43: 131, 1992; KuaS 51: centre page pullout 6, 2000.

Incl. *Sedum graptopetalum* A. Berger (1930).

[2a] **Ros** plants; stems erect or often falling, short, to 10 cm; **Ros** dense, 3 - 4 cm Ø; **L** spatulate, linear, acute, 2 - 4 cm, pale and somewhat glaucous-pruinose; **Inf** few-flowered thyrses; **Fl** 5-merous; **Ped** 4 - 8 mm; **Sep** erect, almost or completely free, linear, acute, 2 - 3 mm, somewhat glaucous;

Pet 8 - 10 mm, yellowish to cream-coloured, tube 2 - 3 mm, lobes acute, 6 - 7 mm, somewhat red-spotted or -banded; **Fil** slender; **NSc** small; **Ca** erect; **Sty** abruptly narrowed. – *Cytology*: $n = 33$.

G. rusbyi (Greene) Rose (Addisonia 9(2): 31-32, pl. 304, 1924). **T**: USA, Arizona (*Rusby* s.n. [CAS, GH, US]). – **D**: USA (C and S Arizona), Mexico (Sonora, W Chihuahua, NW Sinaloa); esp. N-exposed shaded slopes and cliffs, (10-) 600 - 1600 m. **I**: CSJA 56: 169-174, 1984; KuaS 43: 132, 1992. **Fig. XVII.c**

≡ *Cotyledon rusbyi* Greene (1883) ≡ *Dudleya rusbyi* (Greene) Britton & Rose (1903) ≡ *Echeveria rusbyi* (Greene) Nelson & Macbride (1913); **incl.** *Graptopetalum orpetii* E. Walther (1930).

[2b] **Ros** plants; main **R** thickened to 8 mm Ø; stems erect, short, to 1.5 cm, **Br** from below the **Ros**; **Ros** flattened, 2 - 6 (-10) cm Ø, with 10 - 35 (-50) condensed **L**, normally mat-forming; **L** rhombic to obovate to oblanceolate, acute or acutish, 1.5 - 5 × 0.6 - 1.5 mm, 1 - 5 mm thick, pale green or reddish to violet, mucro 1 - 3 mm, at least upper ½ of the **L** papillose; **Inf** 4 - 17 cm, shell-pink or ± violet, thyrses with 2 - 5 spreading 2-branched or mostly zigzag scorpioid 1 - 9 cm long **Br**, these spreading or young coiled, with 2 - 9 (-12) **Fl**, middle **Br** with 1 - 4 secondary **Br** which can again branch; **Fl** (5- to) 6- to 7- (to 10-) merous; **Ped** (1-) 3 - 8 (-13) mm; **Cal** cup-shaped, 2.5 - 4 (-6) × 3 - 6 (-8) mm; **Sep** appressed or upcurved, almost free, elliptic, acute, mucronate, somewhat unequal, 2.5 - 6 × 0.7 - 1.8 mm; **Cl** 14 - 21 mm Ø; **Pet** narrowly triangular-lanceolate, 7 - 10.5 × 1.2 - 2 (-2.5) mm, yellowish-white (white or greenish), tube bowl-shaped, 0.7 - 3.5 × 3 - 4 mm, lobes somewhat acute, with 6 - 8 dark red cross-stripes, more conspicuous and denser in the apical ½; **Fil** 5.5 - 8 mm, epipetal **Fil** fused with the **Cl** for 0.7 - 3 mm, yellowish-white below, red-patterned above; **NSc** ± square, 0.3 - 0.6 × 0.5 - 0.9 mm, white or yellowish; **Ca** 4 - 8 mm, dorsally keeled and with 2 furrows, basally fused for 0.5 - 1 mm, white; **Sty** gradually narrowed, 1 - 1.5 mm, red. – *Cytology*: $n = 31, 32, 33, 62, \pm 93$.

G. saxifragoides Kimnach (Cact. Suc. Mex. 22(2): 40-46, 48, ill., 1977). **T**: Mexico, Durango (*Kimnach* & *Sánchez-Mejorada* 1819 [HNT, BH, ME-XU, US]). – **D**: Mexico (Durango); 2400 m.

[1d] **Ros** plants; stems to 3 × 0.4 - 0.6 cm; **Ros** 2 - 4 cm Ø, with 50 - 60 **L**, densely mat-forming; **L** spreading, linear, linear to oblanceolate or ovate, basally spurred, acute, 1 - 1.5 × 0.4 - 0.5 cm, 2 - 3 mm thick, pale green or completely reddish; **Inf** 1 - 4 per **Ros**, between the middle **L**, 4 - 5 (in cultivation to 11) cm, reddish or violet-brown, thyrses in cultivation 1.5 - 7 cm, with (3-) 5 - 7 (-10) **Fl**, with 1 (-2) unilateral scorpioid **Br**; **Bra** in form and shape ± as the **Ros** leaves; **Ped** 1 - 3 mm; **Fl** 5-merous,

evil-scented; **Cal** bowl-shaped; **Sep** erect to somewhat divergent, free, ± oblong to ovate, acute to bluntish, margins hyaline, equal, 5 - 7 × 2 - 3 mm; **Pet** narrowly lanceolate, 7 - 14 × 2 mm, cream-white to yellowish, tube 0.5 mm, lobes acute to acutish, cream-white, apical ½ continuously patterned with brownish-violet, further down with lax pattern; **Fil** 4 - 6 mm, epipetal **Fil** fused with the **Cl** for 2.5 mm, cream-coloured; **NSc** ± 0.3 × 0.5 mm; **Ca** semi-ellipsoid-oblong, 5 - 7 mm, erect, pressed together, ± rose-white; **Sty** abruptly narrowed, subulate, ± 1 mm. – *Cytology*: $n = 64$.

×GRAPTOPHYTUM

U. Eggli

×*Graptophytum* Gossot (in Marnier-Lapostolle, Liste Pl. Grasses sauf Cact. Jardin Bot. Les Cèdres, 27, 1949).

Incl. ×*Taciphytum* C. H. Uhl (1995).

= *Graptopetalum* × *Pachyphytum*. Only the combination *G. filiferum* × *P. oviferum* (= 'Anita') is known.

×GRAPTOSEDUM

U. Eggli

×*Graptosedum* G. D. Rowley (Name that Succulent, 153, 1980).

= *Graptopetalum* × *Sedum*. 3 cultivars have been named, and 'Heswall' represents the interesting combination *G. bellum* × *S. suaveolens*.

×GRAPTOVERIA

U. Eggli

×*Graptoveria* G. D. Rowley (Nation. Cact. Succ. J. 13(4): 75, 1958). **T**: *Echeveria haworthioides* Gossot. – **Lit**: Keppel (1980-81).

Incl. ×*Echenesia* P. V. Heath (1994).

= *Graptopetalum* × *Echeveria*. Such hybrids appear rather commonly in cultivation and are normally difficult to identify. About 20 taxa and cultivars have been named in the course of time. The hybrid *G. bellum* × *E. laui* is notable, and several named cultivars have been selected in Japan.

The following names are of unresolved application but are referred to this genus: *Echeveria acaulis* Gossot (1936); *Echeveria* × *calva* Gossot (1939) ≡ ×*Graptoveria calva* (Gossot) G. D. Rowley (1958); *Echeveria* × *haworthioides* Gossot (1936) ≡ ×*Graptoveria haworthioides* (Gossot) G. D. Rowley (1958).

HYLOTELEPHIUM

H. Ohba

Hylotelephium H. Ohba (Bot. Mag. (Tokyo) 90: 46-47, 1977). **T:** *Sedum telephium* Linné. – **Lit:** Ohba (1977); Ohba (2001). **D:** Europe, Caucasus, Siberia, E Asia, N America. **Etym:** Gr. 'hyle', forest; and Gr. 'telephion', antique Greek name including *Hylotelephium telephium*; for its frequent occurrence in open forests.

Incl. *Anacampseros* Miller (1754) (*nomen rejiciendum*, Art. 56.1). **T:** *Sedum anacampseros* Linné [neotype, designated by Reveal, Bull. Mus. Nat. Hist. Nat., sér. 4, Sect. B, Adansonia, 13: 197-239, 1991].

Incl. *Telephium* J. Hill (1756) (*nom. illeg.*, Art. 53.1). **T:** *Sedum telephium* Linné [Typification according to P. V. Heath, Calyx 5(4): 131-132, 1997].

Perennial herbs with a **R**stock and sometimes stout **R**; flowering stems arising from adventitious buds on the **R**stock or from basal nodes of the former years' flowering stem, simple, annual or persistent (*H. populifolium*), usually with numerous **L** throughout with visible **Int**, some species with additional sterile shoots; **L** alternate or opposite to 3- to 5-whorled, broad, flat, thickly herbaceous, spurless; **Inf** basically compound cymes, compound or paniculate or umbellate-corymbose in shape, dense, many-flowered, terminal but often also from **Ax** of upper **L**, bracteate; **Fl** hermaphrodite, pedicellate, usually 5-merous (rarely 4-merous), flowering in summer or autumn; **Sep** ± fleshy, green, basally slightly connate; **Pet** always longer than the **Sep**, free, membranous; **St** obdiplostemonous, those opposite the **Pet** basally united with the **Pet**; **Fil** without papillae; **Anth** basifixed; **NSc** small, usually pale yellow; **Ca** free, basally stipitate or attenuate, ventrally not gibbose, placenta marginal, ovules ± ellipsoid, anatropous; **Sty** slender, always shorter than the **Ov**; **Fr** erect follicles, many-seeded; **Se** cylindrical, ± 1 mm; testa brown, fragile, minutely longitudinally striate.

The species here united form a rather well-defined group, with the exception of *H. populifolium*. Until recently, they were traditionally classified as *Sedum*.

The following sections can be recognized:

- [1] Sect. *Hylotelephium*: Flowering stems annual, dying back to the base, usually arising from adventitious buds on the **R**stock, > 20 cm tall, erect to ascending; **L** alternate to verticillate, thickly herbaceous, hardly or a little glaucous; **R**stocks underground, conspicuous, often with fusiform or tuberous **R**.
- [2] Sect. *Sieboldia* (H. Ohba) H. Ohba 1978: Flowering stems annual, usually arising from adventitious buds on the **R**stock, decumbent to pendulous; **L** verticillate, ± slightly fleshy and glaucous.

- [3] Sect. *Populisedum* (A. Berger) H. Ohba 1978: Flowering stems annual but the basal part long persistent and ± woody, arising from axillary buds of the previous year's flowering stem; **R**stocks inconspicuous. Only species: *H. populifolium*.

The following names are of unresolved application but are referred to this genus: *Anacampseros albicans* Haworth (1812) ≡ *Sedum albicans* (Haworth) Steudel (1840); *Sedum affine* Boreau (1866); *Sedum arduennense* Callay ex Boreau (1866); *Sedum brunfelsii* Boreau (1866); *Sedum bulliardii* Boreau (1866); *Sedum callayanum* Boreau (1866); *Sedum clarionii* Boreau (1866); *Sedum confertum* Boreau (1857) (*nom. illeg.*, Art. 53.1); *Sedum controversum* Boreau (1866); *Sedum corymbiferum* Boreau (1866); *Sedum duckbongii* Y. H. Chung & J. H. Kim (1990) (*nom. inval.*, Art. 36.1, 37.1); *Sedum erythromelanum* F. Braun ex Nyman (1879); *Sedum everanum* Ledebour (s.a.); *Sedum fabaria* var. *mongolicum* Franchet (1884) ≡ *Hylotelephium mongolicum* (Franchet) S. H. Fu (1984); *Sedum haematodes* Miller (1768) ≡ *Hylotelephium haematodes* (Miller) Holub (1984); *Sedum intermedium* Déséglise ex Boreau (1866); *Sedum lividum* Willdenow (1814); *Sedum lobelii* Boreau (1866); *Sedum orbiculatum* D. Lee (1998) (*nom. inval.*, Art. 36.1?); *Sedum rigidum* Boreau (1866); *Sedum rotundifolium* D. Lee (1958) (*nom. inval.*, Art. 36.1, 37.1); *Sedum telephium* var. *fuchsii* Déséglise (s.a.); *Sedum thyrsoides* Boreau (1866).

H. anacampseros (Linné) H. Ohba (Bot. Mag. (Tokyo) 90: 47, 1977). – **Lit:** Jalas & al. (1999: 77). **D:** E Spain, S France, SW Switzerland, N Italy (Tyrolian Alps); flowering July to August. **I:** Praeger (1921a: 105); Evans (1983: 106); both as *Sedum*.

≡ *Sedum anacampseros* Linné (1753); **incl.** *Sedum rotundifolium* Lamarck (1779); **incl.** *Anacampseros sempervirens* Haworth (1812); **incl.** *Sedum anacampseros* fa. *majus* Praeger (1921).

[2] Flowering stems procumbent, smooth, 10 - 15 cm long, with several sterile shoots in the basal part; **L** alternate, aggregated, petiolate (lower **L** with petioles 1.5 - 2 cm) or sessile, obovate or ovate to orbicular, 1.2 - 3 × 1.3 - 3 cm, ± glaucous, tip rounded or obtuse, base attenuate to rounded, margins entire; **Inf** semiglobose, dense, many-flowered; **Fl** ± 7 mm Ø; **Sep** triangular-ovate or lanceolate, ± 2 mm, glaucous; **Pet** broadly lanceolate, dullish purple inside, purplish and ± glaucous outside, 4.8 - 5 mm, suberect; **St** nearly as long as the **Pet**; **Fil** purplish, ± 4 mm; **Anth** greenish-yellow or ivory; **NSc** spatulate, ± 0.8 mm, ivory; **Ca** ± 4 mm, pale green with short straight **Sty**.

H. angustum (Maximowicz) H. Ohba (Bot. Mag. (Tokyo) 90: 48, 1977). **T** [lecto]: China (*Przewalski*

347 [LE]). – **D:** NW and W China; flowering August to September.

≡ *Sedum angustum* Maximowicz (1883) ≡ *Sedum telephium* ssp. *angustum* (Maximowicz) Fröderström (1930); **incl.** *Hylotelephium angustum* var. *longipedunculum* J. M. Zhang & K. T. Fu (1999).

[1] **R**stock thickening; flowering stems erect, pale green, ± glaucous, 50 - 80 cm; **L** in whorls of 3 - 5, shortly petiolate to sessile, oblong, 4 - 7 × 1.5 - 2 cm, tip obtuse, base attenuate, margins interruptedly crenate; **Inf** terminal and axillary, semiglobose, dense, many-flowered; **Sep** lanceolate, ± 1 mm; **Pet** oblong, reddish, 3 - 3.5 mm; **St** slightly longer than the **Pet**; **Anth** yellow; **NSc** oblong, ± 0.8 mm; **Ca** 4 - 7 mm, with very short **Sty**.

The recently described var. *longipedunculum* is provisionally placed in the synonymy.

H. bonnafousii (Hamet) H. Ohba (Bot. Mag. (Tokyo) 90: 48, 1977). **T** [lecto]: China, Hubei (*Henry* 7718 [K]). – **D:** China (Hubei, Sichuan); flowers in summer (?).

≡ *Sedum bonnafousii* Hamet (1916).

[1] **R**stock stout; flowering stems erect, 10 - 30 cm, glabrous; **L** alternate, sessile, broadly ovate to orbicular, 4 - 10 × 4 - 10 cm, tip acute, margin entire, glabrous; **Inf** terminal and axillary, paniculate, lax, 8 - 15 × 4 - 8 cm; **Ped** 10 - 15 mm, glabrous; **Bra** lanceolate to narrowly elliptic-ovate, 10 - 14 × 4 - 6 mm; **Sep** lanceolate, 1.2 - 2 mm; **Pet** oblong-ovate, white, 4.3 - 5.7 mm, acuminate; **St** 3 - 5 mm; **NSc** oblong-obovate, 0.5 mm; **Ca** ± 6 mm.

H. callichromum H. Ohba (Bot. Mag. (Tokyo) 90: 48-49, 1977). **T:** Russia, Siberia (*Price* 30 [K]). – **D:** Russia (C Asia, Siberia); autumn-flowering.

≡ *Sedum callichromum* (H. Ohba) R. Stephenson (1994) (*nom. inval.*, Art. 33.1, 33.2).

[1] **R**stock thickened; flowering stems ± 20 cm tall, glabrous; **L** alternate, sessile, narrowly obovate to oblanceolate, 2.5 - 3 × 0.7 - 1 cm, glabrous, tip acute, base attenuate, margins irregularly and remotely crenate; **Inf** terminal, globose, dense, many-flowered, 2.5 - 3 cm long; **Fl** pedicellate; **Sep** triangular, 1.2 - 1.5 mm; **Pet** reddish, lanceolate to oblong-lanceolate, 4 - 4.5 mm, erect; **St** 4.3 - 4.8 mm; **Anth** purplish (?); **NSc** narrowly oblong, ± 0.6 mm, reddish (?); **Ca** 4.5 - 5 mm; **Sty** ± 0.7 mm; ovules 10 - 14.

H. caucasicum (Grossheim) H. Ohba (Bot. Mag. (Tokyo) 90: 49, 1977). **T:** Georgia, Tbilissi (*Bordzilowski* s.n. [LE]). – **D:** Georgia (Transcaucasus), Turkey, Iran; flowers July to September. **I:** Evans (1983: 90, as *Sedum*).

≡ *Sedum maximum* var. *caucasicum* Grossheim (1930) ≡ *Sedum caucasicum* (Grossheim) Borissova (1939) ≡ *Sedum telephium* ssp. *caucasicum* (Grossheim) Takhtajan (1972).

[1] **R** fusiform, thickened; flowering stems 30 -

70 cm tall, ascending to erect, green or purplish, glabrous; **L** opposite, obovate, 5 - 7 × 3 - 5 cm, cordate and amplexicaul with large auricles at the base, tip rounded, margins obscurely and coarsely crenate; **Inf** paniculate, 5 - 12 cm wide; **Bra** ovate or oblong; **Ped** ± 5 mm; **Sep** triangular, ± 1.5 mm; **Pet** ovate, greenish-white, ± 5 mm, spreading; **St** nearly as long as the **Pet** or shorter; **Fil** white; **Anth** yellow; **NSc** oblong, yellow; **Ca** ± 4.5 mm long, greenish.

Closely related to *H. telephium* and not always easy to distinguish. The occurrence in Turkey was recently reported by Sadlo & Stepankova (1999).

H. cauticola (Praeger) H. Ohba (Bot. Mag. (Tokyo) 90: 49, 1977). **T:** Japan (*Miyabe* s.n. [not extant]). – **D:** Japan (Hokkaido); flowers August to September. **I:** Praeger (1921a: 100, as *Sedum*); Ohba (1982b: pl. 144-3).

≡ *Sedum cauticola* Praeger (1917) ≡ *Sedum telephium* fa. *cauticola* (Praeger) Fröderström (1929); **incl.** *Sedum cauticola* fa. *montanum* Hara (1935).

[2] Flowering stems ascending or pendulous, 10 - 15 cm, with slender well-branched **R**stock and **R**; **L** opposite, petiolate, ovate-orbicular to elliptic, 1 - 2.5 × 0.7 - 1.8 cm, glaucous, bluish-white, tip obtuse to acute, margins with a few undulate serrations, petiole 2 - 7 mm; **Inf** corymb-like, globose, with **L**-like **Bra**; **Sep** triangular-ovate, ± 1.5 mm; **Pet** dark pink, lanceolate, 5 - 6 mm; **Anth** reddish purple; **NSc** broadly linear, ± 0.7 mm; **Ca** ± 4.5 mm, abruptly narrowed and stipitate at the base; **Sty** ± 1 mm. – *Cytology*: n = 24 (Ohba 2001: 15).

H. cyaneum (Rudolph) H. Ohba (Bot. Mag. (Tokyo) 90: 50, 1977). **T:** Russia, Siberia (*Schelechow* s.n. [LE]). – **D:** Russia (E Siberia, Sakhalin), N Japan; flowers August to September. **I:** Praeger (1921a: 106); Evans (1983: 108); both as *Sedum*.

≡ *Sedum cyaneum* Rudolph (1811); **incl.** *Sedum lilacinum* Ledebour (1812); **incl.** *Sedum takasui* Kudo (1924) ≡ *Hylotelephium takasui* (Kudo) H. Ohba (1979); **incl.** *Sedum dahuricum* Stephani ex Borissova (1939); **incl.** *Sedum hyperboreum* C. E. C. Fischer ex Borissova (1939).

[2] Rhizomatose with slender creeping main **R** with lateral rootlets, caespitose; flowering stems 5 - 8 cm, often reddish; **L** alternate, sessile, spatulate to oblanceolate, 10 - 13 × 2 - 3 mm, glabrous, tip obtuse (to slightly apiculate), base attenuate, margins entire; **Inf** terminal, cymose, compact, few-flowered, bracteate; **Sep** linear, 2 - 2.5 mm; **Pet** red-purple, narrowly ovate, 5 - 6 mm, spreading; **St** slightly longer than the **Pet**; **Fil** deep purple; **Anth** blackish; **NSc** oblong, ± 1 mm; **Ca** red-purple, 4 - 5 mm, with recurved **Sty**.

H. erythrostictum (Miquel) H. Ohba (Bot. Mag. (Tokyo) 90: 50, 1977). **T:** Japan (*Siebold* s.n. [L]). – **D:** Japan, Korea, E China; flowers September to

October. **I**: Praeger (1921a: 89); Evans (1983: 88); both as *Sedum alboroseum*; Ohba (1982b: pl. 142-4).

≡ *Sedum erythrostictum* Miquel (1866); **incl.** *Sedum alboroseum* Baker (1868) ≡ *Sedum telephium* ssp. *alboroseum* (Baker) Fröderström (1930); **incl.** *Sedum erythrostictum* var. *variegatum* Masters (1878) ≡ *Sedum erythrostictum* fa. *variegatum* (Masters) Hara (1952); **incl.** *Sedum labordei* H. Leveillé & Vaniot (1914) (*nom. inval.*, Art. 32.1c); **incl.** *Sedum okuyamae* Ohwi (1949).

[1] Flowering stems erect, glaucous, 30 - 100 cm, with thickening **R**stock and **R**; **L** alternate or opposite, shortly petiolate, elliptic-ovate to elliptic, 6 - 10 × 2 - 4 cm, pale green, glabrous, tip obtuse, base attenuate, margins serrate; **Inf** corymb-like, semiglobose; **Sep** triangular, ± 1.5 mm; **Pet** pink, elliptic-lanceolate, 5 - 6 mm; **Anth** purplish-red; **NSc** narrowly oblong, ± 0.8 mm; **Ca** ± 5 mm, attenuate at base; **Sty** ± 1 mm. – *Cytology*: 2n = 48, 50 (Uhl & Moran 1972).

H. ewersii (Ledebour) H. Ohba (Bot. Mag. (Tokyo) 90: 50, 1977). **T**: Russia, Siberia (*Ledebour* s.n. [LE]). – **D**: Afghanistan, Pakistan (Karakorum), India (W Himalaya), Tadzhikistan, Kirgizia, Kazakhstan, Russia (Siberia), Mongolia, Tibet, China (Xinjiang, Inner Mongolia); flowers July to August. **I**: Praeger (1921a: 97, as *Sedum*).

≡ *Sedum ewersii* Ledebour (1829); **incl.** *Sedum schrotium* hort. (s.a.); **incl.** *Sedum hayesii* hort. (s.a.) (*nom. inval.*, Art. ?); **incl.** *Sedum gerardianum* Wallich (1828) (*nom. inval.*, Art. 32.1c); **incl.** *Sedum azureum* Royle (1835) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum rubrum* Royle ex Edgeworth (1846); **incl.** *Sedum ewersii* var. *homophyllum* Praeger (1921) ≡ *Sedum ewersii* cv. *Homophyllum* (s.a.); **incl.** *Sedum altaicum* Stephani ex Fröderström (1930) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum ewersii* var. *cyclophyllum* Priszter (1975); **incl.** *Sedum pakistanicum* G. Sarwar (1995).

[2] **R**stocks branching; flowering stems caespitose, procumbent to ascending, glabrous, 10 - 20 cm; **L** opposite, sessile, orbicular to ovate or obovate, 1.5 - 2 × 1.5 - 2 cm, glaucous to pale green, base cordate, tip rounded to obtuse, margins entire or rarely faintly denticulate; **Inf** terminal, dense, 2 - 3 cm wide; **Sep** triangular, 1.5 - 2 mm; **Pet** narrowly ovate, 3.5 - 5 mm, pink or pale purple; **St** as long as the **Pet** or shorter; **Anth** blackish-purple; **NSc** oblong, ± 0.8 mm; **Ca** 4.5 - 5.5 mm, with straight **Sty** ± 0.8 mm; ovules 8 - 10.

H. ×furusei H. Ohba (J. Jap. Bot. 66: 67, ill., 1991). **T**: Japan, Honshu (*Furuse* s.n. [TI]). – **D**: Japan (cultivated).

[1+2] Flowering stems procumbent or decumbent, to 50 cm; **L** usually opposite, with 5 - 10 mm long petiole, lamina broadly oblong or broadly ovate, 2 - 4 × 1.5 - 3 cm, upper face pale green, tip

rounded, base rounded to shortly attenuate, margins crenate with 6 - 8 teeth on each side; **Inf** terminal; **Fl** pedicellate; **Sep** triangular to triangular-ovate, ± 1.7 mm; **Pet** lanceolate, rose, 5.5 - 6 mm; **St** shorter than the **Pet**; **Anth** dark purple; **NSc** linear, ± 0.8 mm; **Ca** 5 - 6 mm; ovules 12 - 14, probably abortive.

A putative hybrid between *H. cauticola* and *H. erythrostictum*, with intermediate characteristics.

H. mingjinianum (S. H. Fu) H. Ohba (Bot. Mag. (Tokyo) 90: 51, 1977). **T**: China, Anhui (Wang 3603 [PE]). – **D**: China (Anhui, Zheijiang, Jiangxi); flowers August to September (?).

≡ *Sedum mingjinianum* S. H. Fu (1965); **incl.** *Hylotelephium tangchiense* R. X. Meng (1992).

[1] **R**stock not massive, with slender long **R**; flowering stems 20 - 35 cm, erect with creeping base, moderately papillate; **L** alternate, sessile, elliptic to obovate or (narrowly) rhombic-elliptic, 4.6 - 8.5 × 0.8 - 2 (-3.7) cm, tip acute, base attenuate, margins entire; **Inf** terminal, 5 - 10 cm wide, dense, bracteate; **Sep** narrowly ovate, 2 - 2.5 mm; **Pet** red-purple, elliptic, 5 - 6 mm; **St** slightly shorter than the **Pet**; **Anth** red-purple (?); **NSc** oblong, ± 0.6 mm; **Ca** 5.5 - 6 mm, **Sty** ± 1 mm; ovules ± 40.

H. pallescens (Freyn) H. Ohba (Bot. Mag. (Tokyo) 90: 51, 1977). **T**: Russia, Chitinskaya Obl. (*Karo* s.n. [W]). – **D**: Russia (E Siberia, Dauriya), NE and N China, Japan (Hokkaido); flowers August to October. **I**: Ohba (1982b: pl. 143-3,4, as *H. telephium*).

≡ *Sedum pallescens* Freyn (1895) ≡ *Sedum telephium* var. *pallescens* (Freyn) Komarov (1903); **incl.** *Sedum telephium* var. *albiflorum* Maximowicz (1883) ≡ *Sedum albiflorum* (Maximowicz) Maximowicz ex Komarov & Alissova (1931); **incl.** *Sedum telephium* var. *eupatorioides* Komarov (1903) ≡ *Sedum eupatorioides* (Komarov) Komarov & Alissova (1931) ≡ *Hylotelephium eupatorioides* (Komarov) H. Ohba (1977); **incl.** *Sedum telephium* var. *orientale* Fröderström (1930); **incl.** *Sedum desmetii* Palibin ex Borissova (1939) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum leptorhizum* Fischer & C. A. Meyer ex Borissova (1939) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum sukaczewii* Maximova (1968).

[1] **R**stock woody, short, with numerous slender **R**; flowering stems 30 - 80 cm, erect or ascending; **L** alternate, sometimes opposite, sessile or shortly petiolate, oblong-ovate to elliptic-lanceolate, 3 - 8 × 1 - 3.5 cm, dull green above with numerous dark reddish dots, pale green beneath, tip rounded, base cunate or rounded, margin nearly entire to crenate with remote and shallow teeth; **Inf** terminal or axillary, dense, many-flowered, 3 - 20 (-30) × 3 - 8 (-10) cm; **Sep** triangular or lanceolate, 2 - 3 mm; **Pet** red-purple, pink or white, elliptic to oblong-elliptic, 4.5 - 6.5 mm; **St** as long as the **Pet**; **Anth** red-purple; **NSc** oblong, ± 0.6 mm, blackish-red; **Ca** 3 -

4 mm, tapering towards the tips; ovules 10 - 14. – *Cytology*: $n = 12$ (Uhl & Moran 1972).

Often confused with *H. telephium* ssp. *telephium*. Plants previously named *S. telephium* var. *purpureum*, *S. purpurascens* or *S. purpureum* in local floras in E Asia and E Siberia are referable to *H. pallescens*.

H. pluricaule (Maximowicz) H. Ohba (Bot. Mag. (Tokyo) 90: 51, 1977). **T** [lecto]: Russia, Sakhalin (*Maximowicz* s.n. [LE]). – **D**: Russia (Amur, Sakhalin), Japan; flowers August to September. **I**: Ohba (1982b: pl. 144-4); Evans (1983: 111, as *Sedum*).

≡ *Sedum telephium* var. *pluricaule* Maximowicz (1883) ≡ *Sedum pluricaule* (Maximowicz) Kudo (1923) ≡ *Hylotelephium triphylla* var. *pluricaule* (Maximowicz) Byalt (1999); **incl.** *Sedum yezoense* Miyabe & Tatewaki (1934) ≡ *Sedum pluricaule* var. *yezoense* (Miyabe & Tatewaki) Tatewaki ex Kawano (1957); **incl.** *Sedum hidakanum* Tatewaki ex Kawano (1957) ≡ *Sedum pluricaule* ssp. *hidakanum* (Tatewaki ex Kawano) Nosaka (1971) ≡ *Sedum pluricaule* var. *hidakanum* (Kawano) Nosaka (1974); **incl.** *Sedum pluricaule* ssp. *ezawae* Nosaka (1971).

[2] Flowering stems erect, ascending or sometimes pendulous, 5 - 10 cm, with well-branched but not thickening **R**stock and **R**; flowering stems arising from the **Ax** of the remaining basal part of the previous year's flowering stem; **L** alternate or opposite, oblanceolate to narrowly obovate-orbicular, 0.5 - 2.5 × 0.4 - 1 cm, tip obtuse to round; **Inf** corymb-like, globose; **Sep** lanceolate-triangular to narrowly triangular, ± 2 mm; **Pet** reddish-purple, broadly lanceolate, ± 2 mm; **Anth** reddish-purple; **NSc** squarish, broadening towards tip, ± 1 mm; **Ca** ± 4 mm; **Sty** ± 1.5 mm; ovules 8. – *Cytology*: $n = 11$ (Uhl & Moran 1972).

H. populifolium (Pallas) H. Ohba (Bot. Mag. (Tokyo) 90: 51, 1977). **T**: Russia, Siberia (*Pallas* s.n. [BM]). – **D**: Russia (W Siberia: Altai, Sayan); flowers June to August. **I**: Praeger (1921a: 148, as *Sedum*).

≡ *Sedum populifolium* Pallas (1776) ≡ *Anacampseros populifolia* (Pallas) Haworth (1812); **incl.** *Sedum notarjannii* Tenore (1811).

[3] **R**stock branching; flowering stems woody, branching in the lower part, perennial, 15 - 40 cm tall, greyish-brown; **L** alternate, petiolate, oblong-ovate to ovate, 1.5 - 4 × 1 - 2.5 cm wide, green, glabrous, tip obtuse or rounded, base truncate to shallowly cordate, margins dentate with large obtuse unequal teeth; **Inf** terminal, globose, 5 - 7 cm broad; **Fl** pedicellate; **Sep** triangular, 1.5 - 2 mm; **Pet** linear-lanceolate, white or pinkish, 4.5 - 6 mm, ascending; **St** as long as the **Pet**; **Anth** dark red; **NSc** oblong, ± 0.6 mm, white; **Ca** 4 - 5 mm, **Sty** ± 1 mm; ovules usually 8.

A very distinctive deciduous miniature shrublet, unlike any other *Hylotelephium*-species.

H. sieboldii (Sweet ex Hooker) H. Ohba (Bot. Mag. (Tokyo) 90: 52, 1977). **T**: [icono]: Curtis's Bot. Mag. 89: t. 5358, 1863. – **D**: China, Japan.

≡ *Sedum sieboldii* Sweet ex Hooker (1863); **incl.** *Sedum sieboldii* var. *erectum* Makino (1901).

H. sieboldii var. *chinense* H. Ohba (J. Jap. Bot. 67(4): 198-200, ills., 1992). **T**: China, Hubei (*Fu & Zhang* 1742 [PE]). – **D**: China.

[2] Differs from var. *sieboldii*: **L** in whorls of 3, broadly obovate or very broadly ovate, 1.7 - 2 × 1.4 - 2 cm, tip rounded, base broadly cuneate or shallowly cordate; **Inf** terminal and axillary, semiglobose; **Bra** narrowly oblong; **Sep** narrowly ovate or oblong-ovate, 1 - 1.3 mm; **Pet** broadly lanceolate or linear-lanceolate, 5 - 6 mm; **NSc** oblong, ± 0.5 mm; **Ca** 5.5 - 6 mm; **Sty** 1.5 - 2 mm; ovules ± 26.

H. sieboldii var. *ettyuense* (Tomida) H. Ohba (J. Jap. Bot. 56: 186, 1981). **T**: Japan, Honshu (*Tomida & al.* s.n. [TI]). – **D**: C Japan. **I**: Ohba (1982b: pl. 144-2).

≡ *Sedum ettyuense* Tomida (1973) ≡ *Hylotelephium ettyuense* (Tomida) H. Ohba (1977); **incl.** *Sedum kagamontanum* Maximowicz (1883) ≡ *Sedum sieboldii* var. *kagamontanum* (Maximowicz) Makino (1910).

[2] Differs from var. *sieboldii*: **L** opposite or sometimes in whorls of 3, ovate to broadly ovate, entire or with few low serrations, petiole very short; **Inf** compound corymb-like, semiglobose. – *Cytology*: $2n = 50$ (Nakata 1996).

The synonymization of *S. kagamontanum*, based on an old illustration in the book Somoku Zusetsu, is tentative.

H. sieboldii var. *sieboldii* – **D**: Japan (Shodo Island); flowers October to November. **I**: Praeger (1921a: 102); Evans (1983: 112); both as *Sedum*; Ohba (1982b: pl. 144-1).

Incl. *Sedum foliis rotundis crenatis* Thunberg (1784) (*nom. inval.*, Art. 23.1).

[2] Flowering stems ascending or pendulous, 15 - 30 cm, with short **R**stock; **L** in whorls of 3, obovate to fan-shaped, 1 - 1.5 × 1.3 - 2 cm, greenish-white, glaucous, tip round, base broadly cuneate, margins with few low undulating serrations; **Inf** corymb-like, globose; **Sep** triangular-ovate, ± 1 mm; **Pet** pink, elliptic to oblanceolate, ± 4 mm; **Anth** dark reddish-purple; **NSc** linear, ± 1 mm; **Ca** ± 4 mm, abruptly narrowed and stipitate at the base; **Sty** 1 mm. – *Cytology*: $2n = 50$ (Nakata 1996).

H. sordidum (Maximowicz) H. Ohba (Bot. Mag. (Tokyo) 90: 52, 1977). **T**: Japan (*Maximowicz* s.n. [LE]). – **D**: Japan.

≡ *Sedum sordidum* Maximowicz (1883).

H. sordidum var. *oishii* (Ohwi) H. Ohba & M.

Amano (J. Phytogeogr. Taxon. 38(1): 4, ill., 1990). **T:** Japan, Honshu (*Oishi* s.n. [TNS]). – **D:** Japan (N Honshu, Ibaraki, Fukushima).

≡ *Sedum oishii* Ohwi (1971).

[1] Differs from var. *sordidum*: **Sep**, **Fil** and **Ov** conspicuously papillate. – *Cytology*: $2n = 22, 24$ (Ohba & Amano 1990).

H. sordidum var. *sordidum* – **D:** Japan (N and C Honshu); flowers September to October.

[1] **R**stock present, flowering stems ascending, 10 - 25 cm, tinged with dull reddish-purple; **L** alternate (or rarely opposite), ovate to ovate-round, $2.5 - 4.5 \times 1.5 - 3$ cm, tinged with reddish-purple, tip obtuse, base attenuate and petiole-like, margins undulate or sparsely lowly crenate; **Inf** corymb-like, globose; **Sep** triangular-ovate, ± 1 mm; **Pet** pale yellowish-green, broadly elliptic, ± 3.5 mm; **Anth** orangish-red; **NSc** linear, ± 0.7 mm; **Ca** ± 3 mm, abruptly narrowed and stipitate at the base; **Sty** ± 1 mm; ovules usually 6. – *Cytology*: $2n = 24$ (Uhl & Moran 1972).

H. spectabile (Boreau) H. Ohba (Bot. Mag. (Tokyo) 90: 52, 1977). **T:** not preserved?. – **D:** NE China, Korea; flowers August to September. **I:** Praeger (1921a: 93); CSJA 36: 140-144, 1964, both as *Sedum*. **Fig. XVII.d**

≡ *Sedum spectabile* Boreau (1866) ≡ *Anacampseros spectabile* (Boreau) Jordan & Fourreau (1867); **incl.** *Sedum telephium* var. *kirinense* Komarov (1903); **incl.** *Sedum pseudospectabile* Praeger (1917) ≡ *Hylotelephium pseudospectabile* (Praeger) S. H. Fu (1980); **incl.** *Sedum spectabile* var. *angustifolium* Kitagawa (1936) ≡ *Hylotelephium spectabile* var. *angustifolium* (Kitagawa) S. H. Fu (1980).

[1] Flowering stems erect, glaucous, greenish-white, 30 - 70 cm, with thickening **R**stock and **R**; **L** opposite or whorled, ovate to narrowly ovate, $7 - 13 \times 5 - 8$ cm, glaucous, tip obtuse, margins with a few undulate serrations; **Inf** corymb-like, large; **Sep** lanceolate, ± 2 mm; **Pet** pink, narrowly oblong, $6 - 7$ mm; **St** longer than the **Pet**; **Anth** reddish-brown; **NSc** broadly linear, ± 0.7 mm; **Ca** ± 6 mm, attenuate at the base; **Sty** ± 1.5 mm; ovules 12 - 16. – *Cytology*: $2n = 50$ (Uhl & Moran 1972).

Frequently planted in gardens in temperate climates, and increasingly also used as a cut flower. Numerous cultivars with different leaf and flower colours are marketed.

H. subcapitatum (Hayata) H. Ohba (Bot. Mag. (Tokyo) 90: 52, 1977). **T:** Taiwan (*Mori* s.n. [TI]). – **D:** Taiwan (Mt. Morrison); flowers July to August. **I:** Tang & Huang (1989: 159); Tang & Huang (1993: 3: 13).

≡ *Sedum subcapitatum* Hayata (1913).

[1] **R**stocks short, woody; flowering stems 10 - 14 cm, erect; **L** alternate, sessile, oblong-ovate to ovate or obovate, $1.5 - 2.8 \times 1 - 2$ cm, glabrous, tip

rounded, base abruptly attenuate or cuneate, margins shallowly and coarsely crenate to nearly entire; **Inf** terminal, globose; **Sep** linear, ± 2 mm; **Pet** white, oblanceolate to broadly oblanceolate, $6 - 7$ mm; **St** longer than the **Pet**; **Anth** red; **NSc** narrowly oblong, ± 1 mm, pale green; **Ca** $7 - 8$ mm; **Sty** ± 3 mm; ovules ± 10 .

H. tatarinowii (Maximowicz) H. Ohba (Bot. Mag. (Tokyo) 90: 52, 1977). **T:** China (*Tatarinow* s.n. [LE]). – **D:** Mongolia, N China; flowers July to August. **I:** Praeger (1921a: 103, as *Sedum*).

≡ *Sedum tatarinowii* Maximowicz (1883); **incl.** *Sedum tatarinowii* var. *integrifolium* Palibin (1895) ≡ *Hylotelephium tatarinowii* var. *integrifolium* (Palibin) S. H. Fu (1984); **incl.** *Sedum definitum* H. Leveillé (1904); **incl.** *Sedum pekinense* H. Leveillé & Vaniot (1904); **incl.** *Sedum almae* Fröderström (1929) ≡ *Hylotelephium almae* (Fröderström) K. T. Fu & G. Y. Rao (1988).

[1] **R**stock thickened, with thick tuberous **R**; flowering stems 8 - 15 cm; **L** alternate, shortly petiolate or sessile, oblanceolate or linear-oblanceolate, $1.2 - 3 \text{ cm} \times 3 - 7 \text{ mm}$, tip triangular, base attenuate, margins crenate with few scattered teeth or entire; **Inf** terminal, flattish, $3 - 5 \text{ cm } \varnothing$; **Fl** pedicellate; **Sep** linear-lanceolate or triangular, $5 - 6 \text{ mm}$; **Pet** white or pinkish, narrowly ovate to lanceolate, $4 - 5 \text{ mm}$, widely spreading; **St** as long as the **Pet** or shorter; **Anth** red-purple; **NSc** oblong, $\pm 0.4 \text{ mm}$, white; **Ca** $4 - 5 \text{ mm}$, **Sty** $\pm 2 \text{ mm}$; ovules 18 - 24.

H. telephioides (Michaux) H. Ohba (Bot. Mag. (Tokyo) 90: 53, 1977). **T:** USA (*Michaux* s.n. [P]). – **D:** USA (S Pennsylvania to W South Carolina and to S Indiana and Illinois); flowers September to October. **I:** Clausen (1975: 71, 88, as *Sedum*).

≡ *Sedum telephioides* Michaux (1803) ≡ *Anacampseros telephioides* (Michaux) Haworth (1812).

[1] Flowering stems erect, $\pm$ glaucous, 30 - 100 cm tall, with thickening **R**stock and **R**; **L** alternate or opposite, shortly petiolate, elliptic-ovate to elliptic, $6 - 10 \times 2 - 4 \text{ cm}$, pale green, glabrous, tip obtuse, base attenuate, margins serrate; **Inf** semi-globose, dense, many-flowered; **Sep** triangular, 1.5 mm ; **Pet** pink, lanceolate-elliptic, $5 - 6 \text{ mm}$; **St** shorter than the **Pet**; **Anth** purplish-red; **NSc** narrowly oblong, $\pm 0.8 \text{ mm}$; **Ca** $5 - 6 \text{ mm}$; **Sty** $\pm 1 \text{ mm}$; ovules 4 per **Ca**; **Fr** $8 - 10 \text{ mm}$; **Se** linear, $\pm 1.2 \text{ mm}$.

H. telephium (Linné) H. Ohba (Bot. Mag. (Tokyo) 90: 53, 1977). **T:** BM [Hort. Cliffortianus]. – **Lit:** 't Hart (1985); Jalas & al. (1999: 72-76 [distribution maps]). **D:** Europe, W Asia.

≡ *Sedum telephium* Linné (1753); **incl.** *Sedum telephium* var. *cordatum* Döll (1843); **incl.** *Sedum candollei* Boreau (1866) (*nom. inval.*, Art. 34.1b); **incl.** *Hylotelephium xzhiguliense* Tzvelev (1993).

The circumscription of the species and its classification into infraspecific taxa are still controver-

sial. *H. xzhiguliense* Tzvelev 1993 represents the hybrid ssp. *telephium* × ssp. *ruprechtii*.

H. telephium ssp. **maximum** (Linné) H. Ohba (Bot. Mag. (Tokyo) 90: 53, 1977). **T:** BM [Hort. Cliffortianus]. – **D:** Europe, W Asia.

≡ *Sedum telephium* var. *maximum* Linné (1753) ≡ *Sedum telephium* ssp. *maximum* (Linné) Krockner (1790) ≡ *Sedum maximum* (Linné) Hoffmann (1791) ≡ *Anacampseros maxima* (Linné) Haworth (1819) ≡ *Hylotelephium maximum* (Linné) Holub (1978); **incl.** *Sedum maximum* Suter (1802); **incl.** *Sedum latifolium* Bertoloni (1819); **incl.** *Sedum telephium* var. *rotundatum* Döll (1843); **incl.** *Anacampseros assurgens* Jordan & Fourreau (1866); **incl.** *Anacampseros cebennensis* Jordan & Fourreau (1866); **incl.** *Anacampseros chlorotica* Jordan & Fourreau (1866); **incl.** *Anacampseros collina* Jordan & Fourreau (1866); **incl.** *Anacampseros corsica* Jordan & Fourreau (1866); **incl.** *Anacampseros delphinensis* Jordan & Fourreau (1866); **incl.** *Anacampseros erubescens* Jordan & Fourreau (1866); **incl.** *Anacampseros millieri* Jordan & Fourreau (1866); **incl.** *Anacampseros minor* Jordan & Fourreau (1866); **incl.** *Anacampseros pachyphylla* Jordan & Fourreau (1866); **incl.** *Anacampseros praeruptorum* Jordan & Fourreau (1866); **incl.** *Anacampseros recurva* Jordan & Fourreau (1866); **incl.** *Anacampseros serotina* Jordan & Fourreau (1866); **incl.** *Anacampseros subrotunda* Jordan & Fourreau (1866); **incl.** *Anacampseros verlotii* Jordan & Fourreau (1866); **incl.** *Sedum maximum* fa. *rufescens* Schur (1866); **incl.** *Anacampseros ternata* Jordan & Fourreau (1866) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum maximum* var. *scherfelii* Borbás (1890) ≡ *Hylotelephium scherfelii* (Borbás) Grulich (1984); **incl.** *Sedum maximum* fa. *umbrosum* Junge (1909); **incl.** *Sedum glaucopruinosum* O. A. Eklund (1928) ≡ *Sedum telephium* var. *glaucopruinosum* (O. A. Eklund) Hiitonen (1932) ≡ *Sedum maximum* ssp. *glaucopruinosum* (O. A. Eklund) Soó (1963) (*nom. inval.*, Art. 33.2); **incl.** *Sedum pseudotelephium* Eklund (1928) ≡ *Sedum telephium* var. *pseudotelephium* (Eklund) Hiitonen (1933); **incl.** *Sedum telephium* ssp. *suecicum* Hylander (1945); **incl.** *Sedum maximum* fa. *nigrum* Domokos (1953); **incl.** *Sedum maximum* fa. *transdanubicum* Péntzes (1956); **incl.** *Sedum maximum* fa. *domokosii* (Péntzes) Soó (1963) (*nom. inval.*, Art. 33.2); **incl.** *Sedum maximum* fa. *atropurpureum* hort. ex Soó (1966).

[1] Differs from ssp. *telephium*: **L** alternate, opposite or whorled, ovate or broadly oblong to oblong-ovate, 4 - 10 cm long, sometimes glaucous, bluntly dentate to subentire, base cordate-amplexicaul or truncate; **Fl** greenish- or yellowish-white, rarely purple.

H. telephium ssp. **ruprechtii** (Jalas) H. Ohba (Bot. Mag. (Tokyo) 90: 53, 1977). **T:** Finland (*Tulla* s.n. [H]). – **D:** NE Europe.

≡ *Sedum telephium* ssp. *ruprechtii* Jalas (1954) ≡ *Sedum maximum* ssp. *ruprechtii* (Jalas) Soó (1963) ≡ *Sedum ruprechtii* (Jalas) Omelczuk (1978) ≡ *Hylotelephium maximum* ssp. *ruprechtii* (Jalas) Dostál (1984) ≡ *Hylotelephium ruprechtii* (Jalas) Tzvelev (1993); **incl.** *Sedum telephium* var. *petraeum* Ruprecht (1860); **incl.** *Sedum polonicum* Blocki (1897) ≡ *Hylotelephium polonicum* (Blocki) Holub (1983); **incl.** *Sedum telephium* var. *stepposum* Borissova (1939) (*nom. inval.*, Art. 36.1); **incl.** *Sedum stepposum* Borissova (1970) ≡ *Hylotelephium stepposum* (Borissova) Tzvelev (1991).

[1] Differs from ssp. *telephium*: Flowering stems decumbent or procumbent, 15 - 40 cm; **L** opposite, suborbicular, glaucous-pruinose, dentate or subentire, base cordate-amplexicaul; **Fl** whitish.

H. telephium ssp. **telephium** – **D:** Europe; flowers August to September.

Incl. *Sedum telephium* var. γ Linné (1753); **incl.** *Sedum telephium* var. *album* Linné (1753); **incl.** *Sedum telephium* var. *purpureum* Linné (1753) ≡ *Sedum purpureum* (Linné) Schultes (1814) ≡ *Sedum telephium* fa. *purpureum* (Linné) Rouy & Camus (1901) ≡ *Sedum telephium* ssp. *purpureum* (Linné) Schinz & Thellung (1909) ≡ *Hylotelephium purpureum* (Linné) Holub (1979); **incl.** *Sedum complanatum* Gilibert (1781) (*nom. inval.*, Art. ?); **incl.** *Anacampseros triphylla* Haworth (1812) ≡ *Sedum triphyllum* (Haworth) Gray (1821) ≡ *Hylotelephium triphyllum* (Haworth) Holub (1983); **incl.** *Anacampseros vulgaris* Haworth (1812) ≡ *Hylotelephium vulgare* (Haworth) Holub (1979); **incl.** *Anacampseros arguta* Haworth (1821) ≡ *Sedum argutum* (Haworth) Sweet (1826) ≡ *Hylotelephium argutum* (Haworth) Holub (1979); **incl.** *Sedum vulgare* Link (1821) ≡ *Sedum telephium* ssp. *vulgare* (Link) Fröderström (1930); **incl.** *Sedum decumbens* Lucé (1823) ≡ *Hylotelephium decumbens* (Lucé) Byalt (1995); **incl.** *Sedum guestphalicum* Boeninghausen ex Reichenbach (1832); **incl.** *Sedum fabaria* W. D. J. Koch (1837) ≡ *Sedum telephium* ssp. *fabaria* (W. D. J. Koch) Kirschleger (1852) ≡ *Sedum maximum* ssp. *fabaria* (W. D. J. Koch) Löve (1961) ≡ *Hylotelephium telephium* ssp. *fabaria* (W. D. J. Koch) H. Ohba (1977); **incl.** *Sedum purpurascens* W. D. J. Koch (1843) ≡ *Sedum telephium* var. *purpurascens* (W. D. J. Koch) D. A. Webb (1961); **incl.** *Sedum maritimum* Boguslaw (1846) ≡ *Hylotelephium maritimum* (Boguslaw) Grulich (1984); **incl.** *Sedum bohusslavii* Ruprecht (1850); **incl.** *Sedum carpaticum* G. Reuss (1853) ≡ *Sedum telephium* var. *carpaticum* (G. Reuss) Domin (1935) ≡ *Hylotelephium carpaticum* (G. Reuss) Soják (1980) ≡ *Hylotelephium argutum* ssp. *carpaticum* (G. Reuss) Dostál (1982); **incl.** *Sedum telephium* var. *ochroleucum* Neilreich (1859); **incl.** *Anacampseros auri-gerana* Jordan & Fourreau (1866); **incl.** *Anacampseros beugesiana* Jordan & Fourreau (1866); **incl.** *Anacampseros borderi* Jordan & Fourreau (1866) ≡

Sedum borderi (Jordan & Fourreau) A. Chevalier (1927); **incl.** *Sedum jullianum* Boreau (1866) $\equiv$ *Anacampteros julliana* (Boreau) Jordan & Fourreau (1867) $\equiv$ *Hylotelephium jullianum* (Boreau) Grulich (1984); **incl.** *Sedum telephium* var. *borderi* Rouy & Camus (1901); **incl.** *Sedum telephium* var. *tarnense* Rouy & Camus (1901); **incl.** *Sedum telephium* fa. *roseo-variegatum* Praeger (1921); **incl.** *Sedum telephium* var. *occidentale* Fröderström (1930); **incl.** *Sedum mugodsharicum* Borissova (1939) $\equiv$ *Hylotelephium mugodsharicum* (Borissova) Grulich (1984); **incl.** *Sedum archangelicum* Ruprecht ex Borissova (1939) (*nom. inval.*, Art. 32.1c); **incl.** *Hylotelephium buxicola* Holub (1984); **incl.** *Hylotelephium confertum* Holub (1984); **incl.** *Hylotelephium convexum* Holub (1984); **incl.** *Hylotelephium dumeticola* Holub (1984); **incl.** *Hylotelephium lapidicola* Holub (1984); **incl.** *Hylotelephium lugdunense* Holub (1984); **incl.** *Hylotelephium monticulorum* Holub (1984); **incl.** *Hylotelephium navieri* Holub (1984); **incl.** *Hylotelephium praecelsa* Holub (1984); **incl.** *Hylotelephium pycnanthum* Holub (1984); **incl.** *Hylotelephium repens* Holub (1984); **incl.** *Hylotelephium rhodanense* Holub (1984); **incl.** *Hylotelephium rubellum* Holub (1984); **incl.** *Hylotelephium rupifragum* Holub (1984); **incl.** *Hylotelephium saxifragum* Holub (1984); **incl.** *Hylotelephium subalbidum* Holub (1984); **incl.** *Hylotelephium viridulum* Holub (1984); **incl.** *Hylotelephium vogesiacum* Holub (1984).

[1] **Rstock** short with numerous fusiform **R**; flowering stems erect or ascending (or very rarely pendulous), 30 - 60 cm; **L** alternate or sometimes partly opposite, sessile, oblong or elliptic-ovate to narrowly ovate, 3 - 6 $\times$ 1 - 2.5 cm, glabrous, dark green, sometimes tinged red, tip obtuse to acute, base cuneate in lower **L** and sometimes truncate in upper **L**, margins usually strongly dentate; **Inf** terminal and sometimes from axils of upper **L**, dense, many-flowered; **Sep** triangular, $\pm$ 2 mm; **Pet** reddish-purple, oblong, 4 - 5 mm, spreading; **Anth** reddish-brown; **NSc** square, $\pm$ 0.5 mm, pale yellow; **Ca** $\pm$ 6 mm; **Sty** $\pm$ 0.7 mm.

Most reports of this species from Siberia and E Asia (China, Korea, Japan) are referable to *H. pallescens*.

H. uralense (Ruprecht) Byalt (Bot. Zhurn. (Moscow & Leningrad) 83(1): 128, 1998). **T**: Russia (*Branth* s.n. [LE]). – **D**: Russia (N and C Ural Mts.); dry stony slopes and rocks, flowers July to August.

$\equiv$ *Sedum uralense* Ruprecht (1854).

[1] Perennial glabrous herbs with annual flowering stems; **R** tuberous or fasciculate; rhizome robust, thick, 2.5 - 3 cm $\varnothing$, erect, $\pm$ 15 cm long, branched towards the tip; flowering **Br** numerous, 35 - 50 cm, 5 - 8 mm $\varnothing$ near the base; **L** lanceolate, 2.5 - 5 cm, shortly petiolate or subsessile, crenate, obtuse; **Inf** compound, racemose-paniculate, with

short lateral **Br** in the **Ax** of the upper **L**; **Fl** 5-merous; **Cl** 4.5 - 5 mm $\varnothing$; **Pet** first greenish, later pink, narrowly lanceolate, acute; **St** longer than the **Pet**; **Fr** erect, lanceolate in outline, 3.5 - 4 mm; **Se** not described. – [V. V. Byalt]

H. ussuriense (Komarov) H. Ohba (Bot. Mag. (Tokyo) 90: 54, 1977). **T** [lecto]: Russia, Far East (*Komarov* 1221 [LE]). – **D**: Russia, Japan.

$\equiv$ *Sedum ussuriense* Komarov (1916); **incl.** *Sedum ussuriense* var. *ochranthemum* Woroshilov & Shlothauer (1984).

H. ussuriense var. **tsugaruense** (H. Hara) H. Ohba (J. Jap. Bot. 68(3): 150, 1993). **T**: Japan, Honshu (*Hara* s.n. [TI]). – **D**: N Japan. **I**: Ohba (1982b: pl. 143-2, as *H. tsugaruense*).

$\equiv$ *Sedum tsugaruense* H. Hara (1957) $\equiv$ *Hylotelephium tsugaruense* (H. Hara) H. Ohba (1977).

[1] Differs from var. *ussuriense*: Flowering stems 10 - 40 cm; **L** opposite, sometimes ternate at the stem base, ovate to elliptic, base rounded to cordate; **Pet** greenish-white, 4 - 6 mm.

H. ussuriense var. **ussuriense** – **D**: Russia (E Siberia, Ussuri); flowers August to September. **I**: Ohba (1993: 150-151).

[1] Flowering stems ascending, 10 - 60 cm tall, with thick **Rstock**; **L** opposite but sometimes alternate in the lower parts, petiolate, very broadly ovate to orbicular, 3 - 5 $\times$ 3 - 5 cm, glaucous, pale green, tip round to truncate, base cordate, margins somewhat undulate; **Inf** corymb-like, globose; **Sep** triangular-ovate, $\pm$ 1.3 mm; **Pet** purple, narrowly oblong, 3 - 4 mm, spreading; **St** slightly longer than the **Pet**; **Anth** reddish-orange; **NSc** broadly linear, $\pm$ 0.5 mm; **Ca** 3 - 4 mm, abruptly narrowed and stipitate at the base; **Sty** $\pm$ 1 mm.

H. verticillatum (Linné) H. Ohba (Bot. Mag. (Tokyo) 90: 54, 1977). **T**: [icono]: Linné, Amoen. Acad. 2: t. 4: fig. 14, 1750. – **D**: Russia, N China, Korea, Japan.

$\equiv$ *Sedum verticillatum* Linné (1753) $\equiv$ *Sedum telephium* fa. *verticillatum* (Linné) Fröderström (1924) $\equiv$ *Sedum telephium* ssp. *verticillatum* (Linné) Fröderström (1930); **incl.** *Sedum verticillatum* fa. *bulbiferum* N. Yonezawa (1986).

H. verticillatum var. **lithophilos** H. Ohba (J. Jap. Bot. 66(2): 63-65, ills., 1991). **T**: Japan, Shikoku (*Ohashi & al.* s.n. [TI]). – **D**: Japan.

[1] Differs from var. *verticillatum*: **L** opposite, petiolate, petioles 1 - 1.8 cm, lamina oblong, ovate, lanceolate or oblanceolate, 3 - 9 $\times$ 3 - 4.5 cm, shallowly crenulate with 6 - 8 teeth on each margin.

H. verticillatum var. **verticillatum** – **D**: Russia (E Siberia, Sakhalin, Kurile Islands, Kamtschatka), N

China, Korea, Japan; flowers August to September. **I:** Ohba (1982b: pl. 142-2). **Fig. XVIIe**

Incl. *Sedum verticillatum* var. *nipponicum* Praeger (1918); **incl.** *Sedum shimizuanum* Honda (1952).

[1] Flowering stems erect (or rarely ascending), 30 - 80 cm; **L** in whorls of 3 (rarely 4 or 5) or opposite, elliptic to narrowly ovate to broadly lanceolate, 3 - 10 × 1.5 - 3 cm, lower face whitish-green, tip subacute, margins sparsely serrate, petiole 2 - 10 mm; **Inf** compound corymbose, large; **Ped** glabrous; **Sep** triangular-ovate, ± 1 mm; **Pet** pale yellowish-green to pale green, broadly oblanceolate, ± 4 mm; **St** as long as the **Pet** or slightly longer; **Anth** pale yellow or rarely dark reddish-brown; **NSc** broadly linear, ± 0.7 mm; **Ca** ± 4 mm, narrowed at the base; **Sty** ± 1 mm. – *Cytology*: *n* = 48 (Uhl & Moran 1972); *2n* = 22, 46, 92 (Funamoto & Yuasa 1986).

H. viride (Makino) H. Ohba (Bot. Mag. (Tokyo) 90: 54, 1977). **T:** Japan (*Makino* s.n. [MAK]). – **D:** Japan; on rocks or epiphytic on tree trunks, flowers September to October. **I:** Ohba (1982b: pl. 142-1).

≡ *Sedum viride* Makino (1901).

[1] Flowering stems ascending, 20 - 50 cm; **L** opposite, petiolate, ovate, 3 - 6 (-10) × 1.5 - 4 cm, tip round to obtuse, base cuneate, petiole 1 - 2 cm; **Inf** corymb-like, globose; **Sep** triangular, ± 1.5 mm; **Pet** pale yellowish-green, elliptic to oblanceolate, ± 4.5 mm; **St** nearly as long as the **Pet**; **Anth** pale reddish-brown; **NSc** linear, ± 0.8 mm; **Ca** ± 4.5 mm, abruptly narrowed and stipitate at the base; **Sty** ± 1.5 mm; ovules 4 - 6. – *Cytology*: *n* = 12 (Uhl & Moran 1972).

H. viridescens (Nakai) H. Ohba (Bot. Mag. (Tokyo) 90: 55, 1977). **T:** Korea (*Taquet* 4249 [TI]). – **D:** S Korea (incl. Cheju-do); flowers August to September. **I:** Praeger (1921a: 87); CSJA 37: 5-8, 1975; both as *Sedum*.

≡ *Sedum viridescens* Nakai (1914); **incl.** *Sedum taquetii* Praeger (1918).

[1] Flowering stems erect, 20 - 60 cm; **L** alternate, opposite or in whorls of 3, sometimes varying on the same individual, sessile, broadly oblong to broadly elliptic or ovate, 2 - 5 × 1.5 - 3 cm, dark green, upper face bluish-glaucous, tip subacute, base rounded, margins serrate with 4 - 6 teeth on each side, or nearly entire; **Inf** terminal and axillary, dense, many-flowered; **Ped** 2 - 4 mm; **Fl** 8 - 9 mm Ø; **Sep** triangular, 1 - 1.5 mm; **Pet** greenish, lanceolate, 4 - 5 mm, spreading; **St** as long as the **Pet** or slightly shorter; **Anth** red; **NSc** oblong, ± 0.5 mm, white; **Ca** 3.5 - 4 mm; **Sty** purplish, ± 1 mm; ovules 10 - 12.

H. viviparum (Maximowicz) H. Ohba (Bot. Mag. (Tokyo) 90: 55, 1977). **T:** Russia, Siberia (*Maxi-*

mowicz s.n. [LE]). – **D:** Russia (E Siberia), China (Manchuria), N Korea. **I:** Lee (1998: 274); CSJA 72(6): 326, 2000.

≡ *Sedum viviparum* Maximowicz (1883) ≡ *Sedum telephium* ssp. *viviparum* (Maximowicz) Fröderström (1930).

[1] Flowering stems erect, 15 - 30 cm; **L** in whorls of 3 or 4 or sometimes opposite, shortly petiolate, lanceolate to oblong-ovate, usually shorter than the **Int**, 3 - 4 × 1.2 - 1.5 cm, dark green above, tip obtuse or rounded, base rounded to cuneate, margins obtusely shallowly serrate; **Inf** terminal, dense, with short peduncle, sometimes proliferating; **Fl** small; **Sep** triangular-ovate, ± 2 mm; **Pet** 3 - 3.5 mm, elliptic to narrowly oblong, whitish or greenish; **St** as long as the **Pet**; **Anth** pale yellow; **NSc** oblong, ± 1 mm, whitish; **Ca** ± 3.5 mm; **Ca** ovate, stipitate, ± 2 mm; **Sty** ± 1 mm; ovules 14 - 20.

HYPAGOPHYTUM

U. Eggli

Hypagophytum A. Berger (NPF2, 18a: 467-468, 1930). **T:** *Sempervivum abyssinicum* Hochstetter [Typification by inference, only element included.]. – **Lit:** Gilbert (1989: 10-11, with ill.); Gilbert (1993). **D:** Ethiopia. **Etym:** Gr. 'hypagein', to deceive, to mislead; and Gr. 'phyton', plant; for the former erroneous classification as *Sempervivum*.

Low growing herbs with a tuber or tuberous rhizome; stems 1 to several, to 26 cm with 4 - 6 nodes, annually deciduous; **L** ternate, obovate, 1 - 3.5 × 0.8 - 2.5 cm, sessile or with a petiole-like base, often obscurely spurred, often streaked with red, with several hydathodes near the margins; **Inf** terminal, with a terminal **Fl** and usually 3 irregularly 1-sided **Br** to 5 cm; **Ped** to 1.7 cm; **Fl** 10- to 12-merous, haplostemonous; **Sep** basally fused for ½ their length, lobes lanceolate, 1.5 - 2.5 × 0.5 - 1 mm; **Pet** free or almost so, 5.5 - 6.5 (-12) × 1.3 - 1.5 mm, white, sometimes with faint pink tinge, stellately spreading; **Fil** ± as long as the **Pet**; **NSc** semicircular, small; **Ca** free, laterally compressed and distinctly constricted to form a lower and an upper part, upper part hispid-papillose, ventral suture ± ciliate; **Sty** filiform, as long as the **Fil**; **Fr** 2-seeded, breaking transversally at the constriction, upper **Se** dispersed within the upper part of the follicle, lower **Se** released separately; **Se** cylindrical-ovoid, dark brown, obscurely longitudinally ridged.

The systematic position of this monotypic genus is unresolved, and its placement in subtribe *Telephinae* is of provisional nature. *Hypagophytum* shares several characters either with *Crassula* or with *Sedum* (Gilbert 1989). The haplostemonous flowers and the presence of hydathodes near the leaf margins point to a relationship with *Crassula*, and the growth form as well as the high sepal and petal

numbers are also found in several specialized species of that genus. The peculiar fruits are vaguely similar to those of *Sedum caeruleum* but their mode of dehiscence is quite unique in the family. A placement in the *Sempervivum* group, based on the superficial similarity due to the high numbers of sepals and petals, appears to be unfounded. Unfortunately, no molecular data is available to elucidate the situation.

H. abyssinicum (Hochstetter ex A. Richard) A. Berger (NPF2 18a: 468, 1930). – **D:** N Ethiopia; highlands, steep rock faces, usually seasonally wet and moss-covered, in sun or shade, 2250 - 3500 m. **I:** Gilbert (1993: 48).

≡ *Sempervivum abyssinicum* Hochstetter ex A. Richard (1847) ≡ *Sedum abyssinicum* (Hochstetter ex A. Richard) Hamet (1912); **incl.** *Sedum malladrae* Chiovenda (1911) ≡ *Crassula malladrae* (Chiovenda) Chiovenda (1919) (*nom. illeg.*, Art. 52.1).

Description as for the genus.

KALANCHOE

B. Descoings

Kalanchoe Adanson (Fam. Pl. 2: 248, 1763). **T:** *Cotyledon laciniata* Linné [Lectotype according to Tölken, Fl. South Afr. 14: 61, 1985.]. – **Lit:** Hamet (1907); Hamet (1908); Berger (1930: 402-412); Boiteau & Mannoni (1948); Boiteau & Mannoni (1949); Hamet & Marnier-Lapostolle (1964); Raadts (1977); Fernandes (1980); Boiteau & Alorge-Boiteau (1995). **D:** Mainly Madagascar and E and S Africa, extending to tropical Africa, Arabia and tropical and SE Asia; some taxa as neophytes throughout the tropics. **Etym:** Phonetic transcription from the Chinese "Kalan Chauhuy" (for *K. spathulata* ?), with the meaning "that which falls and grows", perhaps referring to the bulbils (although no bulbiliferous taxa are native to China); or (Genaust 1996) from ancient Indian 'kalanka-', spot, rust; and 'chaya', gloss; perhaps referring to the glossy and perhaps sometimes reddish leaves of the Indian *K. laciniata*.

Incl. *Crassovia* Commerson ex Lamarck (1786). **T:** not typified.

Incl. *Vereia* H. Andrews (1798). **T:** *Vereia crenata* H. Andrews [Typification according to ING.].

Incl. *Verea* Willdenow (1799) (*nom. inval.*, Art. 61.1). **T:** *Vereia crenata* H. Andrews.

Incl. *Calanchoe* Persoon (1805) (*nom. inval.*, Art. 61.1). **T:** *Cotyledon laciniata* Linné.

Incl. *Bryophyllum* Salisbury (1806). **T:** *Bryophyllum calycinum* Salisbury.

Incl. *Kalenchoe* Haworth (1819) (*nom. inval.*, Art. 61.1). **T:** *Cotyledon laciniata* Linné.

Incl. *Physocalycium* Vest (1820) (*nom. illeg.*, Art. 52.1). **T:** *Vereia crenata* H. Andrews [only element included.].

Incl. *Baumgartenia* Trattinnick (1821) (*nom. illeg.*, Art. 52.1). **T:** *Bryophyllum calycinum* Salisbury [automatic type of replaced synonym, cf. P. V. Heath, Calyx 5(4): 129, 1997.].

Incl. *Crassouvia* Commerson ex De Candolle (1828) (*nom. inval.*, Art. 61.1). **T:** not typified.

Incl. *Meristostylus* Klotzsch (1861). **T:** not typified.

Incl. *Kitchingia* Baker (1881). **T:** not typified.

Incl. *Geaya* Costantin & Poisson (1908). **T:** *Geaya purpurea* Costantin & Poisson.

Perennial succulent shrublets to shrubs, rarely small trees, perennial to biennial or rarely annual succulent herbs, terrestrial to rarely epiphytic, **R** fibrous or rarely thickened to tuberous; stems erect or often procumbent, fleshy or sometimes woody towards the base, generally branched; **L** petiolate to sessile, usually opposite and decussate, sometimes alternate or verticillate, rarely subrosulate, those within a pair free or slightly fused to broadly connate basally, petiole sometimes ± broadly amplexicaul, lamina entire or ± deeply incised, or 3-foliate or pinnately 5-foliate, sometimes ± variable in shape and size from base to top, usually flat, margins usually crenate, serrate or dentate, rarely entire, fleshy-succulent, flat or rarely ± terete, persistent or deciduous, sometimes with bulbils along the margins; **Inf** terminal, rarely axillary, few- to many-flowered, corymbose, cymose to paniculate, sometimes thyrsoïd, composed of cymes, sometimes with bulbils; peduncle usually present, often with a gradual transition from **L** below to shorter **Bra** subtending the **Fl**; **Fl** 4-merous, erect or pendent, often mixed with spreading **Fl**, pedicellate, usually brightly coloured; **Cal** shorter than or sometimes equalling the **Cl** tube, **Sep** free, or ± distinctly connate towards the base, or forming a long tube (sometimes ± inflated) with shorter lobes; **Cl** of united **Pet** forming a ± long tube with erect, spreading or reflexed shorter lobes; **St** 8 in 2 whorls, included or ± exserted; **Fil** inserted on the **Cl** tube at different levels from bottom to top; **NSc** 4, free; **Ca** 4, free to basally somewhat connate; **Sty** shorter or longer than the **Ca**; **Fr** erect follicles; **Se** numerous, minute, usually grooved, ridged or rugulose.

This relatively large genus is taxonomically difficult and its classification is still in a state of flux. No complete recent monograph is available, and the treatment which follows is more of a synoptic nature, following regional floras where possible.

One of the questions discussed for a long time is that whether *Bryophyllum* should be treated as a separate genus. Opinions among botanists are varied on this subject. Hamet (1907) was one of the first to formally integrate *Bryophyllum* into *Kalanchoe*, and he was followed by most authors that have a good personal knowledge of the Madagascan taxa. On the other hand, Berger (1930) recognized the 2 genera as distinct and was followed in the vast majority of recent floristic treatments.

Here, the more conservative treatment is followed, and *Kalanchoe* is seen to embrace 2 sections:

- [1] Sect. *Kalanchoe*: **Cal** tube shorter than the **Cal** lobes, often deeply divided to the base, sometimes **Sep** almost free; **Cal** lobes generally appressed to the **Cl** tube; **Fil** appearing to be inserted at or above the middle of the **Cl** tube, rarely below; **Inf** with all or most of the **Fl** erect; **L** and **Inf** never with bulbils.
- [2] Sect. *Bryophyllum* (Salisbury) Boiteau 1947 (incl. *Kitchingia* Baker): **Cal** tube longer than the **Cal** lobes (sometimes $\pm$ of equal length), often $\pm$ inflated, generally not appressed to the **Cl** tube; **Fil** appearing to be inserted below the middle of the **Cl** tube, rarely above, rarely free or almost free; **Inf** with all or most of the **Fl** pendent; **L** and/or **Inf** of numerous taxa with bulbils.

Some species cannot be unambiguously placed in one of these two sections, which is indicated in the treatments below by giving the section assignment in the form of "1/2" or "2/1", where the first figure indicates the section which the taxon more closely resembles.

A more detailed study is necessary to understand *Kalanchoe* as a whole. The synoptical classification presented above will most probably have to be modified in the future, once the evolutionary lines within the genus are better understood. Sect. *Kalanchoe* appears to form a rather homogeneous group in Africa (with some species with a very wide distribution), but differs in several respects from the Madagascan taxa in the section. In Madagascar, both Sect. *Kalanchoe* and Sect. *Bryophyllum* (the latter here endemic but now with several taxa introduced as neophytes elsewhere) are present. Sect. *Kalanchoe* is somewhat heterogeneous with some rather stable species and some variable species perhaps in the course of rapid evolutionary radiation. Sect. *Bryophyllum* is understood as a group of species showing rapid evolutionary developments and its classification is therefore difficult. Asia is the home of some 14 endemic species from Sect. *Kalanchoe*. They seem to form a separate evolutionary group within the section.

The additional subdivisions proposed by earlier authors such as Hamet (1907), Berger (1930), Boiteau (1947), or Boiteau & Allorge-Boiteau (1995) are too heterogeneous and artificial and cannot be used for a better understanding of the genus.

Numerous taxa of *Kalanchoe* have been very much in fashion towards the end of the last century. Today, *Kalanchoe* are less commonly seen with the exception of a relatively small number of species (esp. *K. blossfeldiana*). Of these, numerous horticultural forms, cultivars and even hybrids are in cultivation. Most species of the genus are of very easy cultivation and they can be multiplied with

stem cuttings or from rooted leaves. Many species of Sect. *Bryophyllum* produce an abundance of bulbils and can become weeds in greenhouses and gardens.

Apart from their horticultural usage, *Kalanchoe* is of limited interest for physiological studies, where some species (e.g. *K. daigremontiana*, *K. delagoensis*) have been extensively used. A limited number of taxa is used medicinally in Madagascar and India.

The following names are of unresolved application but are referred to this genus: *Bryophyllum cochleatum* Lemaire (1859); *Bryophyllum hybridum* hort. (s.a.) (*nom. inval.*, Art. 29.1); *Kalanchoe angolensis* N. E. Brown (1905); *Kalanchoe biternata* Wallich (1832); *Kalanchoe carnea* N. E. Brown (1886); *Kalanchoe cassiopeja* Damman (1893); *Kalanchoe ceratophylla* Haworth (1819); *Kalanchoe cochleata* Lemaire (1859) (*nom. inval.*, Art. 32.1c); *Kalanchoe connata* Sprague (1923); *Kalanchoe cordifolia* G. G. Green (1947) (*nom. inval.*, Art. 32.1c); *Kalanchoe corymbosa* Herb. Madr. ex Wallich (1832); *Kalanchoe granata* G. G. Green (1947) (*nom. inval.*, Art. 32.1c); *Kalanchoe hauseri* Werdermann (1937); *Kalanchoe hybrida* Desfontaines ex Steudel (1840); *Kalanchoe xhybrida* hort. ex H. Jacobsen (1954) (*nom. inval.*, Art. 36.1); *Kalanchoe ndorensis* Schweinfurth (1892); *Kalanchoe petitiana* var. *salmonea* hort. (s.a.) (*nom. inval.*, Art. 29.1); *Kalanchoe praesidentis-malanii* Hamet (1856) (*nom. inval.*, Art. 32.1c, 36.1); *Kalanchoe praesidentis-vervoerdii* Hamet (1960) (*nom. inval.*, Art. 32.1c); *Kalanchoe rosea* C. B. Clarke (1889); *Kalanchoe rosea* A. Chevalier (1920) (*nom. inval.*, Art. 32.1c); *Kalanchoe rotundifolia* var. *aequimag-nisepala* Hamet (1961) (*nom. inval.*, Art. 32.1c); *Kalanchoe rotundifolia* var. *genuina* Hamet (1961) (*nom. inval.*, Art. 32.1c); *Kalanchoe rotundifolia* var. *guillauminii* Hamet (1960) (*nom. inval.*, Art. 32.1c); *Kalanchoe rotundifolia* var. *pseudo-leblanciae* Hamet (1959) (*nom. inval.*, Art. 32.1c); *Kalanchoe rotundifolia* var. *strictifolia* Hamet (1960) (*nom. inval.*, Art. 32.1c); *Kalanchoe sabaia* Miller & Cope (1966) (*nom. inval.*, Art. 29.1); *Kalanchoe smithii* Hamet ex H. Jacobsen (1954) (*nom. inval.*, Art. 32.1c); *Kalanchoe souegesii* Hamet (1961) (*nom. inval.*, Art. 32.1c); *Kalanchoe stearnii* Hamet (1941) (*nom. inval.*, Art. 32.1c); *Kalanchoe stuhlmannii* Engler (1895); *Kalanchoe subamplectens* Wallich (1831); *Kalanchoe wightiana* Wallich ms. (1832) (*nom. inval.*, Art. 32.1); *Meristostylus grandiflorus* Klotzsch (1861).

K. adelae Hamet (Bull. Herb. Boissier, sér. 2, 8: 26, 1908). **T:** Comoro Islands (*Boivin* s.n. [P]). – **D:** Comoro Islands (Grande Comore).

≡ *Bryophyllum adelae* (Hamet) A. Berger (1930); **incl.** *Kalanchoe floribunda* Tulasne (1858) (*nom. illeg.*, Art. 53.1).

[2] Perennials, 30 - 60 cm tall, completely glabrous; stems simple, terete, stout, erect, woody at the base; **L** sessile, fleshy, lamina oblong, 7 - 18 × 2.5 - 5.5 cm, tip obtuse, base widened and amplexicaul, margins entire to crenate; **Inf** lax, paniculate to corymbose; **Ped** 10 - 15 mm; **Fl** pendent; **Cal** campanulate, tube 3 - 4.5 mm, lobes ovate to deltoid, acute, slightly mucronate, 4 - 8.5 × 3.5 - 4.5 mm; **Cl** campanulate-tubular, tube 13 - 15.5 mm, lobes ovate-orbicular, obtuse, mucronate, 3.5 - 5.2 mm long and wide; **St** inserted below the middle of the **Cl** tube, upper **St** slightly exserted; **NSc** semi-orbicular, emarginate, 0.7 - 1 × 1 - 1.2 mm; **Ca** oblong-lanceolate, 7 - 8.5 mm; **Sty** 6 - 9.5 mm.

K. alternans (Vahl) Persoon (Synops. Pl. 1: 446, 1805). **T**: Yemen (*Forsskål* 690 [C]). – **D**: Saudi Arabia, Yemen; dry and exposed places, stony ground, rocky slopes and grassy hillsides, 1800 - 2900 m. **I**: Collenette (1985: 189); Miller & Cope (1996: 476).

≡ *Cotyledon alternans* Vahl (1791) ≡ *Vereia alternans* (Vahl) Sprengel (1825); **incl.** *Kalanchoe heimii* hort. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Cotyledon orbiculata* Forsskål (1775) (*nom. illeg.*, Art. 53.1); **incl.** *Kalanchoe rosulata* Raadts (1972).

[1/2] Perennial **Ros** plants, entirely glabrous, 50 - 75 cm tall (**incl.** **Inf**); **R** thickened; stems few-branched, terete, fleshy, 1 - 1.2 cm Ø at the base; **L** mostly crowded, fleshy-tough, sessile to subsessile, broadly ovate or lanceolate, 2.5 - 12 × 1 - 6.5 cm, pale pinkish-fawn to reddish, tip acute to obtuse, base attenuate, margins usually entire or somewhat crenate; **Inf** few-flowered, very lax, paniculate, to 30 cm; **Ped** 5 - 30 mm; **Fl** pendent or spreading; **Cal** green-yellow, reddish towards tip, tube 0.2 - 0.8 mm long, lobes almost free, narrowly deltoid to lanceolate, acute, spreading, 4 - 10 × 1 - 2.5 mm; **Cl** greenish, yellowish, pinkish, reddish-green, cream or white, tube 4-angled, broadened at the base, 12 - 16 mm, lobes elliptic, lanceolate or oblong-lanceolate, acute, curled, first reflexed then erect, 6 - 18 × 1 - 4.5 mm; **St** inserted towards the top of the **Cl** tube, included; **Anth** ovate; **NSc** linear, 2.8 - 4.5 mm; **Ca** 9 - 11.5 mm; **Sty** 3 - 5 mm.

This is a very ornamental species, widely cultivated in Arabia. The species is notable for a combination of characters: pendent flowers as in Sect. *Bryophyllum*, curled corolla lobes as in some Asiatic species, and spreading sepals not appressed to the corolla, again as in Sect. *Bryophyllum*. After successful pollination, the pendent flowers become erect again.

K. alternans var. **alternans** – **D**: As for the species. [1/2] **L** ovate.

K. alternans var. **lanceolata** Raadts (Willdenowia 25(1): 255-256, ill., 1995). **T**: Yemen, Prov. Hajjah

(*Miller-Hohenstein & Deil* 777 [B]). – **D**: Yemen. [1/2] **L** lanceolate.

K. alticola Compton (JSAB 41: 47, 1975). **T**: Swaziland (*Compton* 32107 [NBG, K, PRE]). – **D**: RSA (Northern Prov.), NW Swaziland; shallow peaty soil on granite rocks.

[1] Greyish perennials to 25 cm tall, completely glabrous, rooting and branching at the base; rhizome horizontal, shallow, elongate; stems terete, flaccid, erect to decumbent; **L** few, sessile, fleshy, flat, round or ovate to oblanceolate, subcoriaceous, 1.5 - 4.5 × 0.8 - 2.2 cm, pale green to brown, usually glaucous, tip obtuse to rounded, base attenuate-cuneate and amplexicaul, margins entire; **Inf** rounded or flat-topped thyrses, few-flowered, to 5 cm wide; **Fl** erect; **Cal** 4 - 7 mm, lobes linear-lanceolate, acute; **Cl** yellow to orange, tube elongate-ampullaceous, 10 - 12 mm, lobes lanceolate, acute, spreading, 5 - 7 × 2 - 3 mm; **NSc** oblong-oblanceolate, 3 - 3.5 mm; **Se** 1 - 1.2 mm.

K. ambolensis Humbert (Bull. Mus. Hist. Nat. (Paris) ser. 2, 5(2): 164-165, 1933). **T**: Madagascar, Sud-Est (*Humbert* 6023bis [P]). – **D**: SE Madagascar; rocks in forests, 700 m.

[2] Perennials, entirely glabrous, 50 - 80 cm tall; stems erect, basally woody; **Br** ascending, fleshy, glaucous; **L** petiolate, fleshy, petiole widened basally, amplexicaul, connate within a pair, 5 - 7 cm, lamina oblong, 10 - 15 × 3 - 6 cm, tip obtuse, margins dentate-crenate, base rounded-peltate or tripartite with obtuse minutely crenate lobes 2 - 6 × 1 - 2 cm; **Inf** corymbiform cymes, 10 - 15 cm tall, with bulbils; **Ped** 1 - 2 cm; **Fl** pendent; **Cal** campanulate, purple-punctate, tube ± 2 mm, lobes lanceolate-deltoid, very acute, 5 - 6 × 3 - 4 mm; **Cl** fleshy, red streaked with purple, tube narrow, ± 4-angled towards the base, ± 9 mm, lobes oblong, obtuse, ± 5 × 4 mm; **St** inserted in the lower ¼ of the **Cl** tube, upper **St** slightly exserted; **Anth** subdeltoid, ± 1.2 mm; **NSc** rectangular to subquadrangular, ± 1 mm; **Ca** ± 5 mm; **Sty** 6 - 7 mm.

K. angustifolia A. Richard (Tent. Fl. Abyss. 1: 313, 1847). **T**: Ethiopia, Shire (*Quartin-Dillon* s.n. [P]). – **D**: Ethiopia (Tigre).

[1] Perennials, glabrous, to 25 cm tall, with thickened **R**; stems terete, slender, erect, glaucescent throughout; **L** thick, fleshy, lamina sublinear, tip subobtuse; **Inf** small, cymose, few-flowered; **Ped** stout, ± 1 cm; **Fl** erect; **Cal** tube almost none, lobes lanceolate, acute, ± 7 mm; **Cl** ± 14 mm long overall, tube much broadened at the base, much narrowed towards the mouth, lobes very long, narrow, very acute, brownish in the middle with yellow margins; **Ca** ± 10 mm; **Sty** ± 2 mm.

Insufficiently known only from the type specimen.

K. annamica Gagnepain (Notul. Syst. (Paris) 3: 219-220, 1916). **T:** Vietnam (*Eberhardt* 1458 [P]). – **D:** Vietnam. **I:** Gagnepain (1920: 703, fig. 72).

[1] Succulent herbs 50 - 70 cm tall; stems glabrous; **L** sessile, thin, linear-oblong, 5 - 6 × 8 - 10 cm, tip acuminate, base attenuate and amplexicaul, margins entire or with 1 - 2 teeth towards the tip; **Inf** panicles to 15 × 7 - 10 cm; **Fl** erect, yellow, with linear spots; **Cal** tube ± 1 mm, lobes lanceolate, acuminate, ± 7 mm; **Cl** tube towards the base much widened, strongly constricted in the middle, widened to 12 mm towards the mouth, 13 - 15 mm, lobes ovate, acuminate, 6 - 7 mm, with numerous veins; **St** inserted above the middle of **Cl** tube, upper **St** slightly exserted; **Anth** ovate-suborbicular, ± 1 mm; **NSc** linear, ± 2 mm; **Ca** oblong, ± 8 mm; **Sty** ± 3 mm, articulate.

A rare endemic species with similarities to *K. spathulata*.

K. arborescens Humbert (Bull. Mus. Nation. Hist. Nat. 5(2): 163-164, 1933). **T** [lecto]: Madagascar (*Humbert & Swingle* 5415 [P]). – **D:** SE Madagascar; xerophytic scrub on limestone and sandy soils. **I:** Boiteau & Allorge-Boiteau (1995: 153, pl. 6: 13-14).

[1] Small trees to 8 m tall, trunk simple below, to 10 cm Ø, branched above; **Br** generally ternate, terminal **Br** 5 - 10 cm, ± fleshy, glabrous; **L** ternate or ± alternate, petiolate, thick, fleshy, glabrous, petiole terete, 1.5 - 3 cm, lamina suborbicular, obovate to spatulate, 1.5 - 4 × 1 - 3 cm, tip rounded, base attenuate, margins entire; **Inf** corymbiform to pyramidal, 2 - 6 cm wide; peduncle 5 - 10 cm, glabrous; **Ped** 1 - 2 cm; **Fl** erect to pendent, glabrous; **Cal** green, tube ± 4 mm, lobes deltoid, acute, 4 - 5 × ± 6 mm; **Cl** thick, fleshy, pale green, sometimes with minute pale purple spots inside, tube 4-angled, ± 9 × ± 8 mm, lobes oblong-deltoid, acute, ± 8 mm; **St** inserted ± in the middle of the **Cl** tube, all slightly exserted; **Anth** oblong, ± 2 mm; **NSc** rectangular to linear, ± 2 × 0.5 mm; **Ca** oblong, ± 5 mm; **Sty** ± 5 mm.

A true small tree and together with *K. dinklagei* the tallest-growing species of the genus. Both are in danger of disappearing in nature.

K. aromatica H. Perrier (Bull. Mus. Nation. Hist. Nat. 29: 454-455, 1923). **T:** Madagascar, Centre (*Perrier* 13976 [P]). – **D:** C Madagascar; rocky slopes. **I:** Boiteau & Allorge-Boiteau (1995: pl. 4: 5); Rauh (1995a: figs. 377-379).

[2/1] Perennial tuft-forming herbs 30 - 60 cm tall, entirely covered with red long viscid glandular **Ha**, aromatic; stems numerous, ± 4-angled, erect, fleshy, reddish; **L** petiolate, fleshy, petiole slender, 1.5 - 3 cm, lamina triangular-lanceolate, oblong-lanceolate to ovate, old **L** often tripartite, 2.5 - 15 × 1.5 - 5 cm, green with black or brown spots in the angles, tip acute, margins serrate-dentate; **Inf** dense

panicles, 8 - 10 cm; **Ped** 2 - 7 mm; **Fl** erect, spreading or pendent; **Cal** green to yellowish, tube 2 - 4 mm, lobes deltoid, acute, cuspidate, 2 - 2.5 mm; **Cl** urceolate, tube cylindrical, 6.5 - 10 mm, white to yellow-green, lobes ovate, obtuse, mucronate, recurved, 5 - 9 × ± 2.5 mm, yellow-green with reddish lines to pink-white; **St** inserted about or below the middle of the **Cl** tube, all long-exserted; **NSc** linear, 1.5 - 2 × ± 0.3 mm; **Ca** 6 - 7 mm; **Sty** 7 - 8 mm; **Se** obovate, ± 0.5 mm.

Intermediate between the 2 sections. The calyx is typical for *Bryophyllum*, while the position of the flowers and the variable insertion of the filaments corresponds to either of the sections. The taxon is interesting for the glandular-hairy aromatic indumentum.

K. aromatica var. **aromatica** – **D:** C Madagascar.

[2/1] At least some older **L** 3-partite; **Cl** ± 17 mm long.

K. aromatica var. **brevicorolla** Boiteau ex Allorge-Boiteau (*Kalanchoe* Madag., 192, pl. 4: 5 (p. 40), 1995). **T:** Madagascar (*François* s.n. in *Herb. Jard. Bot.* 4900 [TAN]). – **D:** C Madagascar.

[2/1] Differs from var. *aromatica*: Plants somewhat smaller; **L** simple, denticulate; **Cl** to 10 mm long.

K. aubrevillei Hamet ex Cufodontis (Österr. Bot. Zeitschr. 114: 149-150, fig. 1a, 1967). **T:** Tanzania, Masai Distr. (*Verdcourt* 1543 [K, BR, EA]). – **D:** Kenya, Tanzania; forest margins and upland grassland on volcanic soils, 1800 - 2500 m.

[1] Perennials, entirely glabrous, ± pruinose, 0.6 - 1.5 m tall, stems terete, erect or decumbent at the base, to 2 cm Ø at the base, yellow-green, mottled with grey streaks; **L** petiolate, green to slightly glaucous, petiole flat or grooved above, semi-amplexicaul, to 10 cm, lamina ovate to subcircular, 18 - 25 × to 15 cm, tip obtuse, base cordate, truncate to subpeltate, the basal part standing out at right angle to the main lamina, margins irregularly lobate to coarsely crenate; **Inf** racemose cymes, to 20 cm long and wide; **Ped** 1 - 2.5 cm, dull purple; **Fl** erect; **Cal** tube ± 1 mm, lobes subulate, attenuate, 9 - 12 × 3 - 4 mm, dull purple; **Cl** white, greenish in the lower part, tube 4-angled, widened at the base, 5 - 6.5 cm, lobes ovate-lanceolate, mucronate, ± 18 × 7 - 8 mm, white; **St** inserted above the middle of the **Cl** tube, upper **St** barely exserted; **Anth** oblong, 2.5 - 3.5 mm, with apical **Gl**; **NSc** linear, ± 7 mm; **Ca** ovate-lanceolate in sideview, ± 25 mm; **Sty** ± 35 mm.

K. ballyi Hamet ex Cufodontis (Österr. Bot. Zeitschr. 114: 150-151, fig. 1b, 1967). **T:** Kenya, Kilifi Distr. (*Jeffery* s.n. in *Bally* 7994 [K, EA]). – **D:** SE Kenya; coastal woodland.

[1] Perennials to 1.2 m tall; stems glabrous; **L** glabrous, sessile, oblong-spatulate, to 20 × 6 cm,

sap green, tip obtuse, base cuneate, semi-amplexicaul, margins entire or irregularly undulate; **Inf** lax, ± 12 cm; **Ped** to 5 mm, glabrous or with short glandular; **Ha**; **Fl** erect, very sparsely glandular-pubescent; **Cal** tube ± 1 mm, lobes lanceolate to oblong-lanceolate, $3.5 - 6 \times 1 - 2$ mm; **Cl** coral-pink to brick-red, tube 8 - 12 mm, lobes obovate, mucronate, $4.5 - 6.5 \times 2.5 - 3.5$ mm; **St** included; **Anth** oblong, ± 0.6 mm; **NSc** linear, 2 - 2.5 mm; **Ca** linear-lanceolate in sideview, ± 6.5 mm; **Sty** 0.5 - 1.5 mm.

K. beauverdii Hamet (Bull. Herb. Boissier, sér. 2, 7: 887-888, 1907). **T** [syn]: Madagascar, Sud (Geay 6313 [P]). – **D**: S and SW Madagascar; xerophytic bush and dry woods on various soils, to 850 m. **I**: FPA 52: t. 2050, 1992; Boiteau & Allorge-Boiteau (1995: 85, pl. 5: 7). **Fig. XVIII.g**

≡ *Bryophyllum beauverdii* (Hamet) A. Berger (1930); **incl.** *Bryophyllum beauverdii* var. *parviflora* Boiteau & Mannoni (s.a.); **incl.** *Kalanchoe costantinii* Hamet (1907) ≡ *Bryophyllum costantinii* (Hamet) A. Berger (1930); **incl.** *Kalanchoe guignardii* Hamet & H. Perrier (1912) ≡ *Kalanchoe beauverdii* var. *guignardii* (Hamet & H. Perrier) Boiteau & Mannoni (1949); **incl.** *Kalanchoe juelii* Hamet & H. Perrier (1914) ≡ *Bryophyllum juelii* (Hamet & H. Perrier) A. Berger (1930) ≡ *Kalanchoe beauverdii* var. *juelii* (Hamet & H. Perrier) Rauh & Hebding (1995) (*nom. inval.*, Art. 33.2); **incl.** *Kalanchoe scandens* H. Perrier (1928) ≡ *Bryophyllum scandens* (H. Perrier) A. Berger (1930); **incl.** *Kalanchoe beauverdii* var. *parviflora* Boiteau & Mannoni (1949); **incl.** *Kalanchoe beauverdii* var. *typica* Boiteau & Mannoni (1949) (*nom. inval.*, Art. 24.3).

[2] Climbers, entirely glabrous; stems slender, weak, procumbent, climbing with support, prolifically branched, woody-wiry below, several m long; **L** with numerous easily caducous bulbils on the teeth, very thick, succulent, sessile to subsessile or shortly petiolate, green, $\pm$ streaked with purple, usually with waxy bloom, very variable in shape and size, linear, narrowly spatulate, hastate, ovate to oblong, sometimes trilobate-hastate, $1.5 - 11 \times 0.3 - 4$ cm, tip acute, base slightly amplexicaul, margins entire or with some minute teeth in the apical $\frac{1}{4}$; **Inf** lax few-flowered cymes; **Ped** 0.6 - 4 cm; **Fl** pendent; **Cal** yellow-green, $\pm$ tinged purple, tube 1 - 10 $\times$ to 12 mm $\varnothing$, lobes triangular, acute, $7 - 13 \times 6.9 - 8.2$ mm; **Cl** campanulate, pale green to grey-green streaked with red-purple, tube 11 - 33 mm, lobes ovate to subcircular, acute, $12 - 17 \times 8 - 19$ mm; **St** inserted near the base of the **Cl**, all exserted; **Anth** ovate, $2 - 2.4$ mm; **NSc** ovate-triangular, $0.8 - 2 \times \pm 2.5$ mm; **Ca** narrowly ovoid, 5 - 8 mm; **Sty** 15 - 17 mm; **Se** $\pm$ cylindrical, ± 0.8 mm.

An extremely variable species, even within populations. This variability is the reason for the numerous synonyms.

K. beharensis Drake (Bull. Mus. Hist. Nat. (Paris) 9: 41, 1903). **T**: Madagascar (*Grandidier* s.n. [P]). – **D**: S and SW Madagascar; xerophytic forests on various soils. **I**: Allorge-Boiteau (1995: fig. 5-8); Descoings (1997a: 26). **Fig. XVII.f, XVII.h**

Incl. *Kalanchoe vantieghemii* Hamet (1906); **incl.** *Kalanchoe beharensis* var. *aureo-aeneus* H. Jacobsen (1970) (*nom. inval.*, Art. 36.1, 37.1); **incl.** *Kalanchoe beharensis* var. *subnuda* H. Jacobsen (1970) (*nom. inval.*, Art. 36.1, 37.1).

[1] Shrubs 2 - 3 m tall; stems simple below with resinous bark, branched above and pubescent, erect, stout, 2 - 12 cm $\varnothing$, with conspicuous **L** scars with sharp projections on either side; **L** few, congested near **Br** tips, petiolate, petiole terete, fleshy, 4 - 10 cm, lamina deltoid to peltate, sometimes $\pm$ regularly lobate, $7 - 40 \times 8 - 30$ cm, glabrous and pruinose to $\pm$ densely white to brownish pubescent with stellate **Ha**, tip acute, base emarginate; **Inf** axillary many-flowered panicles 20 - 30 cm tall; peduncle 40 - 50 cm; **Ped** 4 - 13 mm; **Fl** placed in all directions, very pubescent; **Cal** yellow-green with reddish lines, tube 1 - 3 mm, lobes deltoid, acute, 5 - 13 mm; **Cl** urceolate, pink-greenish to green-yellow, tube 6 - 10 mm, lobes ovate, acute, $5 - 13 \times 3 - 6$ mm; **St** inserted near the top of the **Cl** tube, all exserted; **NSc** rectangular, basally connate with each other, $\pm 1 \times 1.5 - 3$ mm; **Ca** 5 - 12 mm; **Sty** 5 - 10 mm; **Se** obovate, ± 0.7 mm.

One of the larger species of the genus and very decorative. The indumentum is of variable colour and density even within populations, and some forms are marketed as cultivars in the horticultural trade.

K. bentii Wright ex Hooker (CBM ser. 3, 57: t. 7765 + text, 1901). **T**: Yemen (*Bent* s.n. [K]). – **D**: Arabian Peninsula, Somalia.

[1] Perennial subshrubs 1 - 1.5 m tall; stems simple, terete, erect, thick, 2 - 4 cm $\varnothing$ at the base, smooth, glabrous, dull olive-green; **L** sessile, glabrous, thickly fleshy, dagger-shaped, $\pm$ cylindrical, $7 - 40 \times 0.5 - 2.5$ cm, glaucous, olive-green, spreading and recurved, terete to $\pm$ triangular in cross-section, grooved above, rounded below, tapering to the acute tip, gradually contracted from the middle to the semi-amplexicaul base, margins entire; **Inf** corymbose many-flowered panicles to 20 cm; **Ped** 5 - 18 mm; **Fl** erect, glabrous or glandular-papillose; **Cal** tube 0.7 - 1 mm, lobes lanceolate to ovate-lanceolate, acute, $5 - 17 \times 1.5 - 3.5$ mm, fleshy, olive-green, spreading; **Cl** pure white to whitish and pink-tinged, tube cylindrical to ± 4 -angled, inflated towards the base, 2 - 4 cm, lobes ovate, acute-mucronate, $10 - 16 \times 2 - 6$ mm, spreading and recurved; **St** inserted near the throat of the **Cl** tube, upper **St** slightly exserted; **Anth** oblong to ovate; **NSc** linear, $6 - 7 \times \pm 0.5$ mm; **Ca** slender, narrowly oblong, 12 - 15 mm; **Sty** 5 - 8 mm; **Se** oblong, 1 - 1.2 mm.

A hardly ornamental but resistant and interesting taxon, easily propagated by suckers. As in *K. alternans*, the sepals are spreading and not appressed to the corolla tube.

K. bentii ssp. **bentii** – **D**: S Yemen (Hadhramaut); rocky slopes, limestone, in bushland, 700 - 1500 m. **I**: Miller & Cope (1996: 476, fig. 91).

Incl. *Kalanchoe teretifolia* Deflers (1893) (*nom. illeg.*, Art. 53.1); **incl.** *Kalanchoe deflersii* Gagnepain (1916).

[1] Plants entirely glabrous.

K. bentii ssp. **somalica** Cufodontis (Webbia 19: 741, 1965). **T**: Somalia, Erigavo Region (*Peck* s.n. in *Bally* 4274 [K]). – **D**: N Somalia; rocky places, 1400 - 1500 m.

[1] Stems and **L** glabrous; inside of **Cal** lobes and outside of **Cl** glandular-papillose.

K. bergeri Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 2: 199-202, 1914). **T**: Madagascar (*Perrier* 10091 [P]). – **D**: C-S Madagascar (Andringitra); granite rocks, 2400 m.

Incl. *Kalanchoe bergeri* var. *glabra* Boiteau & Mannoni (1948); **incl.** *Kalanchoe bergeri* var. *typica* Boiteau & Mannoni (1948) (*nom. inval.*, Art. 24.3).

[2] Small annual or biennial herbs 10 - 30 cm tall, entirely glandular-hairy or sometimes $\pm$ glabrous; stems few-branched, procumbent, reddish; **L** petiolate, petiole fleshy, slightly amplexicaul, 5 - 15 mm, lamina fleshy, oblong, oblong-orbicular, orbicular to obovate, 1 - 4 $\times$ 0.7 - 2.4 cm, tip very obtuse to rounded, base attenuate, margin crenate; **Inf** small up to 5-flowered cymes, sometimes with a single **Fl** only; **Ped** 15 - 18 mm; **Fl** pendent; **Cal** densely pilose, tube 0.5 - 2 mm, lobes deltoid to oblong, acute, 7 - 10 mm; **Cl** urceolate, pale yellow, tinged red, sparsely pilose, tube 10 - 12 mm, lobes ovate, obtuse, 6 - 8 $\times$ 7 - 9 mm; **St** inserted below the middle of the **Cl** tube, all included; **Anth** ovate, $\pm$ 2 mm; **NSc** trapezoid, emarginate, 1 - 1.6 mm; **Ca** ovate, 7 - 10 mm; **Sty** 4 - 7 mm; **Se** obovate, $\pm$ 1 mm.

K. bhidei T. Cooke (Fl. Bombay 497, 1903). **T**: India, Deccan (*Bhide* 1243 [K [iso]]). – **D**: S India; dry scrub, 1000 - 1700 m. **I**: Saldanha (1984: 360, fig. 55).

[1] Entirely glabrous succulents, completely pale brown to reddish, 60 - 100 cm tall; stems erect; **L** petiolate, tinged red, petiole flat, enlarged at the base, lamina elliptic-obovate to elliptic-oblong, 5 - 9.5 $\times$ 2 - 5 cm, tip obtuse, base cuneate, margins coarsely and irregularly crenate-serrate; **Inf** lax spreading many-flowered cymose panicles; **Ped** slender, 6 - 9 mm; **Fl** erect, spreading or pendent, pure white or with a greenish tinge; **Cal** divided to the base, lobes triangular to lanceolate, acute to ac-

uminate, 4.5 - 6 $\times$ $\pm$ 2.5 mm; **Cl** tube subcylindrical, widened at the base, 8 - 15 mm, lobes oblong to obovate, acute, apiculate, $\pm$ 4 $\times$ 1.5 mm; **St** inserted near the top of the **Cl** tube, all exserted; **Anth** ovate, $\pm$ 1.5 mm; **NSc** linear, acute, $\pm$ 3 mm; **Ca** oblong, 8 - 9 mm; **Sty** 4 - 6 mm.

Long misidentified, this species has recently been rediscovered at several localities.

K. bipartita Chiovenda (Result. Sci. Miss. Stefani-Paoli Somalia Ital. 75, 1916). **T**: Somalia, South (*Paoli* 674 [FI]). – **D**: Somalia, C Kenya; deciduous bushland on arid red soil, 850 m. **I**: Wickens (1987: 57, fig. 8).

[1] Perennials 10 - 20 cm tall, **R**stock tuberous; stems simple, erect, hairy; **L** mainly basal, petiolate, petiole 1 - 2 cm, subamplexicaul, lamina oblong-ovate to broadly ovate, 3 - 8 $\times$ 1.8 - 4.5 cm, sparsely hairy to glabrescent, tip obtuse, base cuneate or attenuate, margins entire to shallowly and irregularly crenate; **Inf** few-flowered cymes; **Ped** 1.5 - 4 mm; **Fl** erect; **Cal** tube $\pm$ 0.2 mm, lobes triangular to linear-triangular, 2.5 - 2.8 mm; **Cl** orange or red, flecked with longitudinal purple markings, tube cylindrical, slightly inflated in the lower part, 12 - 14 mm, lobes ovate, acute, 3.5 - 6 $\times$ 1.5 - 2 mm; **St** inserted in the upper part of the **Cl** tube, all included; **NSc** linear, 2 - 3 mm; **Ca** cylindrical-lanceolate in sideview, 9 - 11 mm, **Sty** $\pm$ 2 mm; **Se** ovoid, $\pm$ 0.4 mm.

An aberrant species and quite distinct, but closely related to *K. fadeniorum*.

K. blossfeldiana von Poellnitz (RSN 35: 159-160, 1934). **T**: Madagascar (*Perrier* 17883 [P]). – **D**: N Madagascar; in the shade of forests, 1600 - 2400 m. **I**: Boiteau & Allorge-Boiteau (1995: 189); Rauh (1995a: figs. 380-382).

$\equiv$ *Kalanchoe coccinea* var. *blossfeldiana* (von Poellnitz) Boiteau (1995) (*nom. illeg.*, Art. 52.1); **incl.** *Kalanchoe globulifera* var. *coccinea* H. Perrier (1928) $\equiv$ *Kalanchoe coccinea* (H. Perrier) Boiteau ex Allorge-Boiteau (1995) (*nom. illeg.*, Art. 53.1).

[1] Perennial herbs forming dense tufts, glabrous and smooth all over, to 40 cm tall; stems erect, little-branched; **L** petiolate, fleshy, dark green, shining, often edged with red, petiole grooved above, 0.5-2.5 cm, lamina oblong to ovate-oblong, 3 - 7 $\times$ 2 - 4 cm, tip obtuse to acute, base cuneate to $\pm$ rounded, margins entire in lower part, above irregularly sinuate-crenate; **Inf** terminal and axillary dense many-flowered head-like thyrses; peduncle to 15 cm; **Ped** 3 - 4 mm; **Fl** erect; **Cal** green, tube 0.5 - 1 mm, lobes lanceolate to oblong-deltoid, acute, 3 - 5 mm; **Cl** cylindrical, scarlet, tube 7 - 9 mm, lobes oblong-obovate, obtuse to mucronate, 4 - 6 $\times$ 2 - 2.5 mm; **St** inserted towards the top of the **Cl** tube, all included; **Anth** orbicular, $\pm$ 0.4 mm; **NSc** linear, emarginate, 2 - 2.5 $\times$ 0.3 - 0.5 mm; **Ca** 4.5 - 5 mm; **Sty** 1 - 1.5 mm.

This species was introduced into cultivation around 1930. Ever since, it has been grown in great numbers due to its ease of cultivation and its brilliant flowers. Today, it ranks amongst the most important succulents in horticulture, and numerous hybrids and cultivars with different flower colours (red, purple, pale violet, yellow, orange, whitish) have been created by horticulturists.

K. bogneri Rauh (KuaS 44(9): 181-185, ill., 1993). **T:** Madagascar (*Bogner* 2138 [M, HEID]). – **D:** W-C Madagascar; on cliffs with rock crevices with black humus. **I:** Rauh (1995a: figs. 1006-1010).

[2] Perennials, completely glabrous and covered with a white farinose bloom (excl. **Cl** lobes), to 1 m tall; stems numerous, erect, thick, to 15 mm Ø, few-branched at the base; **L** sessile, fleshy, green-bluish, ovate-elongate, 6 - 13 × 4 - 7 cm, tip obtuse to rounded, base attenuate, amplexicaul, margins red, entire to minutely serrate; **Inf** corymbose cymes, 20 - 30 cm; **Ped** 2 - 2.5 cm; **Fl** pendent; **Cal** urceolate, slightly 4-angled, 2.4 - 2.7 cm, lobes deltoid, acute; **Cl** tube pale green towards the base, pale to vivid red-orange above, upper part 4-angled, ± 3.5 cm, lobes pale red, obtuse, erect, 1 - 1.2 cm; **St** included; **Anth** ± 2 mm; **NSc** short, oblong; **Ca** ± 3.8 mm; **Sty** ± 3 mm.

K. boisii Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 2: 149-153, 1914). **T:** Madagascar (*Perrier* 11808 [P]). – **D:** W Madagascar; limestone.

[1] Small annual herbs 10 - 30 cm tall, entirely and ± densely covered with long glandular **Ha**; stems slender, procumbent; **L** fleshy, dark green with red spots, petiolate near the base of the stems to sessile near the tips, petiole slender, cylindrical, to 6 mm, lamina ovate, oblong to elliptic, 1.5 - 2.5 × 0.2 - 1.5 cm, tip obtuse, base attenuate, margins irregularly crenate; **Inf** few-flowered corymbiform cymes, 2 - 5 cm; **Ped** 3 - 6 mm; **Fl** erect; **Cal** tube ± 0.6 mm, lobes deltoid, 1.2 - 1.6 × 0.9 - 1.2 mm; **Cl** golden-yellow, sparsely pilose to subglabrous, tube subcylindrical, 12 - 13 mm, lobes ovate, obtuse, acuminate, 5 - 6 × 2 - 3 mm; **St** inserted above the middle of the **Cl** tube, all included; **Anth** ovate, ± 1 mm; **NSc** linear, obtuse, 4.5 - 5.5 mm; **Ca** narrowly oblong, 7 - 9 mm; **Sty** 2.5 - 3 mm; **Se** obovate, ± 1 mm.

Insufficiently known species, close to *K. briquetii*.

K. boranae Raadts (Willdenowia 13(2): 378-380, ill., 1983). **T:** Kenya (*Bally & Smith* 14892 [K]). – **D:** NE Kenya; dry rocky places, 930 - 1450 m.

[1] Perennial glabrous shrublets to 2 m tall; **L** petiolate, green, slightly pruinose, petiole terete, grooved above, broadened at the base, ± purplish, to 7 cm, lamina oblong-ovate to subcordate, to 30 × 15 cm, tip acute, base truncate to subcordate, margins

crenate or doubly crenate; **Inf** paniculate cymes, to 50 × 30 cm; **Ped** 9 - 15 mm; **Fl** erect; **Cal** tube 0.5 - 1 mm, lobes narrowly lanceolate, 7 - 13 × 1.5 - 2.5 mm; **Cl** tube 17 - 19 mm, yellowish-green, lobes 9 - 10 × 5 - 6.5 mm, cream or yellow; upper **St** exerted; **Anth** 1.3 - 1.5 mm, with apical **Gl**; **NSc** linear, 3 - 4 mm; **Ca** 10 - 12 mm; **Sty** 3 - 4 mm.

K. bouvetii Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 2: 192-195, 1914). **T:** Madagascar (*Perrier* 937 [P]). – **D:** NW Madagascar; moist shady rocks.

= *Bryophyllum bouvetii* (Hamet & H. Perrier) A. Berger (1930).

[2] Perennials 10 - 40 cm tall, with underground **Rstock**; stems decumbent, covered with long simple **Ha** and shorter glandular **Ha**; **L** of sterile stems thick, ± pilose with simple **Ha**, petiole 5 - 6 mm, lamina 1.5 - 3 × 0.5 - 1 cm; **L** of flowering stems thin, petiolate, petiole 7 - 10 mm, lamina green with brown spots, narrowly ovate-oblong, oblong to sublinear, 6 - 7.5 × 0.5 - 2.5 cm, tip acute to obtuse, base attenuate, margins irregularly crenate; **Inf** corymbose panicles, 3 - 19 cm; **Ped** 3 - 7 mm, pilose and glandular; **Fl** pendent, pilose and glandular; **Cal** tube 4 - 5 mm, lobes deltoid, subacute, 2 - 3.5 × 1.5 - 2.4 mm; **Cl** white, pink to purple, tube ± 4-angled, 11 - 23 mm, lobes obovate, acute, 3 - 6 × 2.5 - 4.5 mm; **St** inserted at or above the middle of the **Cl** tube, all included; **Anth** ovate, 0.5 - 1 mm; **NSc** linear, acute, ± 3 mm; **Ca** oblong-ovoid, 5 - 8 mm; **Sty** 7 - 17 mm; **Se** obovate, ± 0.7 mm.

K. brachyloba Welwitsch ex J. Britten (FTA 2: 392, 1871). **T:** Angola, Huila (*Welwitsch* 2486 [K]). – **D:** Widespread in S Africa from Zaïre to Moçambique, Namibia and RSA; woodland and bushland, sandy or stony ground or rock fissures. **I:** Hamet & Marnier-Lapostolle (1964: figs. 100-101); Tölken (1985: 68: fig. 8:2).

Incl. *Kalanchoe multiflora* Schinz (1888); **incl.** *Kalanchoe baumii* Engler & Gilg (1903); **incl.** *Kalanchoe pyramidalis* Schönland (1907); **incl.** *Kalanchoe pruinosa* Dinter (1923).

[1] Perennial or biennial shrublets, completely glabrous, 0.6 - 2 m tall, with subglobose or napiform **R** tuber or woody **Rstock**; stems simple, terete, erect, green; **L** subrosulate, sessile or subsessile, fleshy, very succulent, lanceolate, oblong, ovate, elliptic to spatulate, glaucous, grey-green ± tinged red along margins, 5 - 28 × 2.5 - 8 cm, tip obtuse or rounded, base attenuate, distinctly amplexicaul, margins usually serrate-lobed or crenate or entire and undulate; **Inf** ± dense flat-topped corymbose cymes, 5 - 45 cm; **Ped** 6 - 15 mm; **Fl** erect; **Cal** pale green, tube 0.7 - 1.5 mm, lobes lanceolate to broadly triangular, obtuse, fleshy, 0.7 - 5 × 1.5 - 2.7 mm; **Cl** tube 4-angled-cylindrical to almost pyramidal, yellowish-green, 10 - 15 mm, lobes ovate to semi-orbicular, acute, yellow to orange-yellow, 2 - 5 × 2 - 4

mm; **St** inserted above the middle of the **Cl** tube, slightly exerted; **Anth** ovate, 0.5 - 1 mm; **NSc** linear-lanceolate, obtuse or emarginate, 1.5 - 4 × 0.5 - 0.7 mm; **Ca** 8.5 - 12 mm; **Sty** 0.5 - 1.5 mm; **Se** 1.6 - 2 mm.

K. bracteata Scott Elliot (JLSB 29: 15, 1891). **T:** Madagascar (Scott Elliot 2993 [K, P]). – **D:** SE Madagascar; rather common in xerophytic scrub on various soils and rocks. **I:** Boiteau & Allorge-Boiteau (1995: 143, pl. 6: 15-16). **Fig. XVII.g, XVIII.a**

Incl. *Kalanchoe nadyae* Hamet (1907); **incl.** *Kalanchoe ebracteata* Scott Elliot ex H. Jacobsen (1954) (*nom. inval.*, Art. 61.1); **incl.** *Kalanchoe bracteata* var. *longisepala* Boiteau ex Allorge-Boiteau (1995); **incl.** *Kalanchoe bracteata* ssp. *glabra* Rauh & Hebding (1997); **incl.** *Kalanchoe bracteata* var. *aurantiaca* Rauh & Hebding (1997); **incl.** *Kalanchoe bracteata* var. *glabra* Rauh & Hebding (1997); **incl.** *Kalanchoe bracteata* var. *pubescens* Rauh & Hebding (1997).

[1] Much-branched shrublets to 1.5 m tall, clothed with very characteristic **Ha**-scales (stellate **Ha** with 3 oblong-triangular acute branches), generally very dense, often very appressed and covered with a waxy secretion resulting in a glabrous appearance; stems woody, densely branched, young obscurely 4-angled; **L** petiolate, greyish-silvery white to olive-green, petiole fleshy, cylindrical, canaliculate above, 5 - 20 mm, lamina ovate, elliptic to lanceolate, 2 - 7 × 1 - 4 cm, tip cuneate-acute, base rounded, margins entire; **Inf** cymes; **Ped** ± 1 cm; **Fl** erect, sometimes spreading; **Cal** tube very short to almost absent, lobes deltoid, very acute, 4 - 9 mm; **Cl** urceolate, red, very fleshy, tube 4-angled, 10 - 16 mm, lobes rounded, ± 2 × 1 mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** ovate, 1.5 - 2 mm; **NSc** rectangular, ± 1.5 mm; **Ca** 6 - 10 mm; **Sty** 2 - 2.5 mm.

Easily confused with *K. hildebrandtii* which has the same overall appearance, the same ecological requirements, and sometimes occurs in mixed stands. The remarkable indumentum of the leaves is at the same time very delicate and very much appressed so that the plants appear glabrous.

Recently, Rauh & Hebding (1997) described ssp. *glabra* with 3 varieties as listed above in the synonymy; in view of the apparently continuous variation encountered in nature, these taxa are of doubtful taxonomic value.

K. briquetii Hamet (Annuaire Conserv. Jard. Bot. Genève 15-16: 142-143, 1912). **T:** Madagascar (Goudot s.n. [P]). – **D:** N Madagascar; sandy shore.

[1] Perennials; stems simple, erect, slender, pilose; **L** slender-petiolate, pilose, alternate below, opposite above, lamina tripartite, segments trilobate, margins ± distinctly crenate; upper **L** sessile, lamina linear-oblong, tip acute; **Inf** short few-flowered cy-

mose panicles; **Ped** slender, pilose, 3.8 - 4 mm; **Fl** erect; **Cal** sparsely pubescent, tube ± 0.2 mm, lobes oblong-deltoid, acute, 4.4 - 5.2 × 1 - 1.5 mm; **Cl** sparsely pilose, tube ± 6 mm, lobes suboblong, ending with a long ridge, ± 3.5 × 1.5 mm; **St** inserted above the middle of the **Cl** tube, exerted; **Anth** ovate-orbicular, 0.6 - 0.8 mm; **NSc** linear, obtuse, 2.2 - 2.4 × ± 0.2 mm; **Ca** 4.5 - 5.5 mm; **Sty** 3.5 - 4 mm; **Se** obovate, ± 1.3 mm.

Only known from the original description and not recollected since. It appears to be rather close to *K. boisii* and *K. chapottii*.

K. campanulata (Baker) Baillon (Bull. Mens. Soc. Linn. Paris 1(59): 469, 1885). **T:** Madagascar (*Kitching* s.n. [K, P]). – **D:** C and C-E Madagascar; forests, forest edges, bushland, on rocks. **I:** Boiteau & Allorge-Boiteau (1995: 53); Rauh (1995a: figs. 383-384).

≡ *Kitchingia campanulata* Baker (1881) ≡ *Bryophyllum campanulatum* (Baillon) Hort. ZSS (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Kitchingia amplexicaulis* Baker (1883) ≡ *Kalanchoe amplexicaulis* (Baker) Baillon (1885); **incl.** *Kitchingia panduriformis* Baker (1883) ≡ *Kalanchoe panduriformis* (Baker) Baillon (1885); **incl.** *Kitchingia parviflora* Baker (1883) ≡ *Kalanchoe parviflora* (Baker) Baillon (1885); **incl.** *Kalanchoe campanulata* ssp. *orthostyla* Boiteau & Mannoni (1948); **incl.** *Kalanchoe campanulata* var. *typica* Boiteau & Mannoni (1948) (*nom. inval.*, Art. 24.3).

[2] Epiphytic perennials, glabrous, to 1.5 m; stems simple, erect; **L** thick, fleshy, generally sessile, sometimes with a broad petiole, lamina linear-oblong, oblong to ovate, 8 - 10 × 2 - 3.5 cm, white-pruinose, somewhat spotted, tip cuneate, base amplexicaul, margins regularly crenate; **Inf** dense corymbs, 5 - 8 cm, with numerous bulbils; **Ped** 10 - 12 mm; **Fl** pendent; **Cal** subcampanulate, tube 2 - 3 mm, lobes subdeltoid to ovate, acute, 4 - 6 × 3.6 - 4.9 mm; **Cl** red to orange-pink, urceolate to campanulate, inside with some glandular **Ha**, tube 10 - 13 mm, lobes ovate, 5 - 7 × 6 - 8 mm; **St** inserted below the middle of the **Cl** tube, upper **St** included; **Anth** ovate, ± 1.5 mm; **NSc** rectangular to obovate, 1 - 1.8 × ± 1 mm; **Ca** 7 - 9 mm; **Sty** 7 - 9 mm; **Se** ± 0.8 mm.

Variable in almost all characters of leaves, petioles, calyx lobes and corolla. The species is notable for the otherwise rare bulbil production in the inflorescences.

K. ×cantabrigiensis Hort. Cantabr. ex Guillaumin (Bull. Mus. Nation. Hist. Nat., Sér. 2, 2: 579, 1930).

Shrublets; stems pilose becoming glabrous; **L** petiolate, thick, sparsely pubescent, later glabrous, petiole 1.5 - 2.5 cm, lamina broadly ovate, tip rounded, base cuneate, margins crenate, to 10 × 8 cm; **Inf** corymbose, to 4 cm long; **Ped** ± 5 mm, pilose; **Fl** sparsely pilose; **Cal** 3 mm, lobes ovate,

rounded-apiculate; **Cl** tube inflated, yellow-greenish, ± 8 mm long, lobes broadly ovate, apiculate, ± 4 mm; **St** inserted near the throat of the **Cl** tube, included; **NSc** linear, ± 2.5 mm.

This hybrid was produced by Lynch in Cambridge around 1928; its parentage is unknown.

K. chapototii Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 3: 64-67, 1915). **T**: Madagascar (Perrier 1451 [P]). – **D**: W Madagascar (Ambongo, Namoroka); calcareous rocks in forests.

[1] Perennials to 45 cm tall, entirely clothed with long-stipitate glandular **Ha**; stems erect; **L** petiolate, petiole slender, 8 - 9 mm, lamina 3-partite (rarely 5-partite), 1 - 7.5 $\times$ 0.7 - 1.4 cm, segments oblong to linear, 2.5 - 7 $\times$ 0.6 - 2.5 cm, tips acute, margins irregularly lobed and crenate; **Inf** many-flowered corymbs, 4 - 10 cm wide; **Ped** slender, 6 - 10 mm; **Fl** erect; **Cal** hairy, tube 0.8 - 1 mm, lobes deltoid, acute, 2 - 3.6 $\times$ 1.6 - 2 mm; **Cl** golden-yellow, sparsely hairy, tube $\pm$ 4-angled at the base, 19 - 22 mm, lobes ovate, 6 - 8 $\times$ 5 - 5.5 mm, ending with a ± 4 mm long acumen; **St** inserted near the top of the **Cl** tube, slightly exserted; **Anth** ± 2.2 mm, with a small apical **Gl**; **NSc** linear, obtuse, 2.5 - 3 mm; **Ca** narrowly oblong, 22 - 28 mm; **Sty** 15 - 18 mm; **Se** obovoid, ± 1 mm.

K. cherukondensis Subba Rao & Kumari (Bull. Bot. Surv. India 17: 177-179, ill., 1978). **T**: India, Andhra Pradesh (Subba Rao & Kumari 39300 [CAL]). – **D**: India (Andhra Pradesh); rocky places, 1100 m.

[1] Perennials, entirely reddish-brown, to 30 cm tall; stems simple, erect, terete, stouter at the base, tapering abruptly at the top, glabrous; **L** sessile, broadly spatulate to obovate or elliptic, covered with minute blood-red spots, 1.2 - 8 $\times$ 0.4 - 6.5 cm, tip obtuse to acute (young **L**) or round to emarginate, base attenuate, margins irregularly crenate, scaly; **Inf** paniculate cymes; **Ped** glabrous to densely glandular-hairy, 6 - 16 mm; **Fl** erect; **Cal** reddish-brown, glabrous, eglandular, divided nearly to the base, lobes lanceolate, acuminate, 7 - 13 $\times$ 1.5 - 2.5 mm; **Cl** white, glandular-pubescent, tube $\pm$ cylindrical, 3 - 9 mm, lobes lanceolate, acuminate, $\pm$ prominently 7-veined, 5 - 7 mm; **St** inserted in the upper part of the **Cl** tube, slightly exserted; **Anth** ovate, ± 1 mm; **NSc** subulate, 1.5 - 5 mm; **Ca** subulate, ± 5 mm; **Sty** ± 5 mm.

In cultivation, leaves up to 12 $\times$ 8.5 cm are formed, and the plants are coloured greenish-red. This species is intermediate between *K. olivacea* and *K. bhidei*.

K. chevalieri Gagnepain (Notul. Syst. (Paris) 3: 275, 1914). **T**: Vietnam (Chevalier 30537 [P]). – **D**: Vietnam (Annam-Region).

[1] Perennials (?) to 50 cm high and more; **L** petiolate, petiole terete, widened to the base and amplexicaul, ± 4 cm, lamina ovate-oblong to linear-lanceolate, 8 - 10 $\times$ 0.7 - 5 cm, tip obtuse, acuminate, base truncate to abruptly attenuate, margins dentate-crenate; **Inf** corymbose, ± 5 cm wide; **Ped** 4 - 5 mm; **Fl** erect, orange; **Cal** divided to the base, lobes ovate-oblong, acuminate, $\pm 5 \times 2$ mm; **Cl** tube widened and 4-angled at the base, 12 - 14 mm, lobes lanceolate, acute, $\pm 6 \times 3$ mm; **St** inserted above the middle of the **Cl** tube, exserted; **Anth** sessile, oblong, ± 1.3 mm; **NSc** linear-filiform, ± 4 mm; **Ca** oblong, 6 - 7 mm; **Sty** ± 3 mm.

Insufficiently known and probably close to *K. lanceolata*.

K. citrina Schweinfurth (Bull. Herb. Boissier 4(Appendix 2): 199-200, 1896). **T**: Yemen (Schweinfurth 1831 [K, LE, WU]). – **D**: Arabian Peninsula (Yemen), Ethiopia, Somalia, N Uganda, Kenya; deciduous woodland, bushland and grassland, thickets, sandy-loamy soil, stony ground or rock crevices, 1000 - 2000 m. **I**: Gilbert (1989: 21); Miller & Cope (1996: fig. 90).

Incl. *Kalanchoe citrina* var. *erythraeae* Schweinfurth (1896); **incl.** *Kalanchoe citrina* var. *longipetiolata* Hamet (1958) (*nom. inval.*, Art. 32.1c); **incl.** *Kalanchoe citrina* var. *ballyi* Hamet ex Wickens (1982).

[1] Perennials, entirely tomentose with shaggy pointed non-glandular **Ha**, 20 - 150 cm tall; stems erect or decumbent at the base, grey; **L** sessile or petiolate, velvety, grey or brownish-green, petiole to 2 cm, flattened and grooved above, lamina lanceolate to $\pm$ rhombic, or ovate to subcircular, to 12 $\times$ 4 cm, tip acute or obtuse, base cuneate, margins dentate to subentire or rarely dissected; **Inf** cymose, small, dense, flat-topped, to 15 cm; **Ped** 1 - 5 mm, stout; **Fl** erect; **Cal** tube ± 1 mm, tomentose, lobes subulate to triangular-lanceolate, 4 - 8 $\times$ 1 - 8 mm; **Cl** pale lemon- or golden-yellow or buff-orange-pink, tomentose, tube 10 - 12 mm, lobes obovate, mucronate, 5 - 7 $\times$ 2.8 - 3.5 mm; **St** included; **Anth** oblong-ovate, 0.7 - 1.1 mm, with apical **Gl**; **NSc** linear-lanceolate, 2.5 - 3.5 mm; **Ca** linear-lanceolate in sideview, 6 - 8.5 mm; **Sty** 1 - 2 mm.

K. craibii Hamet (BMI 1914: 281, 1914). **T**: Thailand (Kerr 2823 [not located]). – **D**: Thailand; dry scrub jungle, 300 m.

[1] Perennials (?); stems simple, erect, glabrous, upper part sometimes pilose; **L** petiolate, petiole slender, widened at the base, lamina 3-partite at the base, segments linear; **Inf** corymbiform; peduncle very short; **Ped** ± 9 mm; **Fl** erect, yellow; **Cal** subcampanulate, pilose, tube ± 1.2 mm, lobes linear-sublanceolate, acute acuminate, $\pm 8.5 \times 2.6 - 2.8$ mm; **Cl** tubular, lower part widened, tube ± 10.5 mm, lobes obovate-suborbicular, cuspidate, $\pm 10.5 \times 7$ mm; **St** inserted above the middle of the **Cl**

tube, exserted; **NSc** linear, acute, $\pm 3.5 \times 0.2$ mm; **Ca** ovate-lanceolate in sideview, ± 9.5 mm; **Sty** ± 2.3 mm.

A little-known species, appearing close to *K. grandiflora* or *K. laciniata*.

K. crenata (Andrews) Haworth (Synops. Pl. Succ., 109, 1812). **T:** Sierra Leone (*Afzelius* s.n. [BM, BJ]). – **D:** Widespread in tropical Africa from the Central African Republic to RSA, as well as in Arabia; naturalized in tropical America, India, Malaysia and Australia; in forest, bushland and grassland, mostly moist and damp places, to 2300 m. **I:** Wickens (1987: 44); Miller & Cope (1996: fig. 90B).

$\equiv$ *Vereia crenata* Andrews (1798) $\equiv$ *Cotyledon crenata* (Andrews) Ventenat (1804) $\equiv$ *Kalanchoe integra* var. *crenata* (Andrews) Cufodontis (1969); **incl.** *Kalanchoe crenata* var. *crenata*; **incl.** *Cotyledon crenata* auct. (s.a.) (*nom. illeg.*, Art. 29.1, 53.1); **incl.** *Cotyledon vereia* Jacquin (1804) $\equiv$ *Kalanchoe crenata* var. *verea* (Jacquin) Cufodontis (1958) (*nom. illeg.*) $\equiv$ *Kalanchoe integra* var. *verea* (Jacquin) Cufodontis (1969); **incl.** *Cotyledon brasiliica* Vellozo (1829) $\equiv$ *Kalanchoe brasiliica* (Vellozo) Stellfield (1947); **incl.** *Kalanchoe brasiliensis* Cambessedes (1830); **incl.** *Kalanchoe hirta* Harvey (1862); **incl.** *Kalanchoe afzeliana* Britten (1871); **incl.** *Kalanchoe coccinea* Welwitsch ex Britten (1871) $\equiv$ *Kalanchoe crenata* var. *coccinea* (Welwitsch ex Britten) Cufodontis (1958); **incl.** *Kalanchoe brittenii* Hamet (1916); **incl.** *Kalanchoe schumacheri* Koorders (1958); **incl.** *Kalanchoe integra* var. *crenato-rubra* Cufodontis (1969); **incl.** *Kalanchoe crenata* ssp. *nyassensis* R. Fernandes (1978); **incl.** *Kalanchoe crenata* ssp. *bieensis* R. Fernandes (1980).

[1] Perennial shrubs 0.3 - 2 m tall, pubescent, **Ha** usually ≤ 0.5 mm; stems 1 to several, erect, fleshy, terete, glabrous or glabrescent towards the base and $\pm$ glandular-pubescent above; **L** petiolate, fleshy, horizontal or deflexed, glabrous or upper **L** sparsely glandular-pubescent, petiole 1 - 4 cm, flattened and grooved above, $\pm$ clasping, lamina ovate, obovate-oblong to spatulate, concave, yellowish-green to deep green, $3 - 30 \times 2 - 20$ cm, tip obtuse, base cuneate and decurrent, margins crenate, irregularly crenate to sometimes sublobate; **Inf** large many-flowered paniculate cymes, 25 - 40 cm; **Ped** 2 - 10 mm; **Fl** glabrous or glandular-pubescent, erect; **Cal** tube 0.1 - 1.5 mm, lobes lanceolate to linear-lanceolate, attenuate, acute, green, sometimes lineolate with red, $2 - 8 \times 3 - 4$ mm; **Cl** red, reddish-orange, yellow, lower part pale or greenish-yellow or white, tube elongate-ampullaceous, papery, 8 - 17 mm, lobes oblong-lanceolate to elliptic, acute, long-mucronate, $3 - 8 \times 1.5 - 5$ mm; **St** inserted towards the top of the **Cl** tube, all included or upper **St** exserted; **Anth** oblong, 0.5 - 1 mm, with apical **Gl**; **NSc** linear to narrowly oblong, rounded at the tip,

1.5 - 4.5 mm; **Ca** linear-lanceolate, 5 - 10 mm; **Sty** 1 - 4.5 mm; **Se** ± 1 mm.

K. crenata is a very polymorphic taxon and many varieties have been recognized. Fernandes has described 2 subspecies (ssp. *nyassensis* and ssp. *bieensis*), which differ primarily in the dimensions of various floral parts. Since the general variation patterns of the species are not yet understood, they are here tentatively placed as synonyms. This also applies to *K. hirta* from Zimbabwe and RSA (Tölken 1985).

K. crundallii I. Verdoorn (FPA 25: t. 967 + text, 1946). **T:** RSA, Northern Prov. (*Crundall* 27157 [PRE]). – **D:** RSA (Northern Prov.); among boulders in forested areas.

[1] Somewhat fleshy glabrous pruinose perennials; stems simple, erect or decumbent, terete, to 90 cm tall, to 1.4 cm $\varnothing$ near the base, occasionally rooting; **L** petiolate, somewhat fleshy, petiole flattened, 5 - 20 mm, ± 5 mm broad, lamina waxy green to yellowish-green, often bordered with red, orbicular, rarely broadly oblong or obovate, $3 - 7 \times 2 - 5.5$ cm, tip broadly rounded, base cuneate, margins entire or crenate; **Inf** short $\pm$ oblong cymose panicles; **Ped** slender, 1 - 1.5 mm; **Fl** varying in the course of anthesis from erect to pendent, finally erect again; **Cal** lobes fleshy, deltoid, $2 - 5 \times \pm 2$ mm; **Cl** greenish-yellow to deep yellow $\pm$ tinged red for parts not exposed to direct sunlight, coral-red with darker red patches when exposed to the sun, tube cylindrical 4-angled, slightly contracted at the throat, 14 - 15 mm, lobes ovate, broadly rounded at the tip, apiculate, slightly recurving, $3 - 4 \times \pm 3$ mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** 1.2 - 1.5 mm; **NSc** oblong, tip rounded, light green, $2 - 2.5 \times \pm 1.5$ mm; **Ca** oblong, ± 8 mm; **Sty** ± 2.5 mm; **Se** ± 1.5 mm.

A decorative species, esp. due to the variable flower colours depending on light exposure. The variable position of the flowers during their anthesis is also notable and is accompanied by colour changes (buds erect, yellowish; open flowers pendent, red; spent flowers erect, brown-red).

K. curvula Descoings (J. Bot. Soc. Bot. France 4: 79-81, pl. 1, 1997). **T:** Madagascar (*Herb. Jard. Bot. Tananarive* 11 [P]). – **D:** Madagascar (without precise locality, perhaps N Madagascar).

[2] Perennials (?), entirely glabrous; stems terete, simple, erect; **L** petiolate, imparipinnate, very fleshy, thick, purple-edged, petiole 2 - 2.5 cm, broadly amplexicaul, rachis thickened, canaliculate; leaflets in 1 - 3 pairs, sessile, oblong to lanceolate, $2.2 - 2.7 \times 0.8 - 1$ cm, tips cuneate, obtuse, base asymmetrically rounded, margins strongly and irregularly crenate with thick obtuse teeth, terminal leaflet elliptic, $\pm 3 \times 2$ cm; **Inf** globose many-flowered panicles, 30 - 35 cm; **Ped** terete, 5 - 10 mm; **Fl** in all directions; **Cal** pale green lined with

purple, tube cylindrical, 7 - 7.5 mm, lobes deltoid, acuminate, 2.5 - 3 × 3 - 4 mm; **Cl** pink, slightly curved, often strongly recurved when dry, tube cylindrical, 22 - 25 mm, lobes ovate, ± long-acuminate, recurved, 5 - 6 × ± 4 mm; **St** inserted near the base of the **Cl** tube, slightly exserted; **Anth** lanceolate, 1.2 - 1.5 mm; **NSc** rectangular, emarginate, 1.8 - 2 × 0.8 - 1 mm; **Ca** ovoid, 5 - 6 mm; **Sty** 20 - 22 mm.

K. cymbifolia Descoings (J. Bot. Soc. Bot. France 4: 81-83, pl. 2, 1997). **T**: Madagascar (*Anonymus* s.n. [P [unpubl. pl. 106]]). – **D**: N Madagascar (Ambilobé).

[2] Perennials (?), almost entirely glabrous, to 1 m tall; stems simple, terete, straight, erect; **L** sessile, lamina elliptic to ovate-elliptic, 12 - 16 cm, strongly concave and resembling a boat, tip ending with a large acute acumen, base widened into a thick amplexicaul very short petiole, margins irregularly crenate with acute teeth; **Inf** lax few-flowered panicles, 7 - 12 cm; **Ped** terete, recurved, 10 - 12 mm; **Fl** pendent; **Cal** campanulate, tube cylindrical-conical, 10 - 12 mm, lobes ovate-elliptic, acute, acuminate, ± spreading, 6 - 8 mm; **Cl** tube cylindrical, glandular-pilose at the base, 20 - 25 mm, lobes ovate-elliptic, acute, ± spreading, 6 - 8 mm; **St** inserted near the base of the **Cl** tube, included; **Anth** ovate; **NSc** ± rectangular, longer than wide, emarginate, 1 - 2 mm, spreading; **Ca** oblong, 5 - 7 mm; **Sty** 7 - 10 mm.

K. daigremontiana Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 2: 128-132, 1914). **T**: Madagascar (*Perrier* 11798 [P]). – **D**: SW Madagascar; open woods, on sandstone or limestone; naturalized in some tropical countries (e.g. India). **I**: Hamet & Marnier-Lapostolle (1964: figs. 35-38); Boiteau & Allorge-Boiteau (1995: 93). ≡ *Bryophyllum daigremontianum* (Hamet & H. Perrier) A. Berger (1930).

[2] Biennials, entirely glabrous, 40 - 80 cm tall; stems simple, erect or decumbent, brownish; **L** dark green, pink-green to purplish-green with brown-red spots, petiolate, sometimes peltate, petiole amplexicaul, 1 - 5 cm, lamina ovate, oblong-ovate to long-triangular, often ± folded, 2 - 20 × 1 - 3.5 cm, tip acute, base ± rounded, margins regularly dentate, with numerous bulbils on the teeth; **Inf** lax many-flowered paniculate cymes; **Ped** 5 - 11 mm; **Fl** pendent or spreading; **Cal** tube 3 - 4 mm, lobes deltoid, acute, 3 - 5 × 2.2 - 3.6 mm; **Cl** campanulate, reddish to purple, tube 16 - 19 mm, lobes obovate, acute, 7 - 8 × 3.5 - 4.5 mm; **St** inserted below the middle of the **Cl** tube, upper **St** exserted; **Anth** reniform, 1.5 - 2 mm; **NSc** ± rectangular, tip obtuse to emarginate, ± 0.6 × 1 mm; **Ca** ± 6 mm; **Sty** 11 - 15 mm.

The leaves are very variable in size and colour as well as in shape (from linear to broadly deltoid, sometimes ± trilobate). This species hybridizes eas-

ily with several others (*K. rosei*, *K. delagoensis*). It is frequently cultivated in tropical gardens.

K. deficiens (Forsskål) Ascherson & Schweinfurth (Mém. Inst. Égypt. 2: 79, 1889). **T** [neo]: Yemen (*Deflers* 572 [P]). – **D**: Yemen.

≡ *Cotyledon deficiens* Forsskål (1775) ≡ *Kalanchoe glaucescens* var. *deficiens* (Forsskål) Senni (1905); **incl.** *Cotyledon integra* Medikus (1775) ≡ *Kalanchoe integra* (Medikus) Kuntze (1891); **incl.** *Cotyledon nudicaulis* Murray (1784) (*nom. illeg.*, Art. 52.1) ≡ *Vereia nudicaulis* (Murray) Sprengel (1825) (*nom. illeg.*, Art. 52.1); **incl.** *Cotyledon aegyptiaca* Lamarck (1786) (*nom. illeg.*, Art. 52.1) ≡ *Kalanchoe aegyptiaca* (Lamarck) De Candolle (1801) (*nom. illeg.*, Art. 52.1); **incl.** *Cotyledon nudicaulis* Vahl (1791).

[1] Perennials, clump-forming, to 1.5 m tall, entirely glabrous or glandular-hairy in upper part; **L** petiolate, fleshy, light grey-green, glabrous, petiole broad, 0.5 - 2 cm, lamina elliptic, ovate to broadly obovate, 4 - 10 × 2.5 - 5 cm, tip obtuse, base cuneate, margins entire or crenate; **Inf** corymbiform, 7 - 12 cm; **Ped** 2 - 6 mm, ± glandular-hairy; **Fl** erect, clothed with short ± dense glandular **Ha**; **Cal** tube 0.2 - 0.5 mm, lobes narrowly ovate to lanceolate, acute, 3 - 6.5 × 1 - 2 mm; **Cl** scarlet, orange-red to pink, tube ± cylindrical, a little widened at the base, 8 - 12 mm, lobes ovate to obovate, mucronate, 5 - 7 × 2.2 - 4 mm; **St** inserted towards the top of the **Cl** tube, upper **St** slightly exserted; **Anth** ovate, 1 - 1.2 mm; **NSc** linear, 3 - 3.5 mm; **Ca** 7.5 - 8 mm; **Sty** 2 - 4 mm.

Fernandes (1980) questions the status of this taxon, but both Raadts (1981) and Miller & Cope (1996) accept it as a good species. It is sometimes cultivated as an ornamental in Arabia, Egypt and Ethiopia.

K. deficiens var. *deficiens* – **D**: N and S Yemen; open scrub and steep rocky slopes, 1400 - 1800 m. **I**: Miller & Cope (1996: fig. 90A).

[1] Plants glandular-hairy above, glabrous below; **Cl** orange-red or pink, lobes 5 - 7 × 3.5 - 4 mm.

K. deficiens var. *glabra* Raadts (Willdenowia 18 (2): 423-426, 1989). **T**: Yemen, Hajjah Prov. (*Miller-Hohenstein & Deil* 635 [B]). – **D**: N Yemen; rocky slopes, terrace walls and grassy banks around fields, 600 - 2200 m.

Incl. *Kalanchoe glaucescens* ssp. *arabica* Cufo-dontis (1965).

[1] Plants entirely glabrous; **Cl** orange, scarlet or salmon-red, lobes 5 - 7 × 2.2 - 4 mm.

K. delagoensis Ecklon & Zeyher (Enum. Pl. Afric. Austral., 3: 305, 1837). **T**: Moçambique (*Owen* s.n. [S]). – **D**: C-S Madagascar; open wooded grasslands, rocky slopes, on sandy or rocky ground; cul-

tivated and naturalized throughout the tropics. **I:** Tölken (1985: 74, fig. 10, as *Bryophyllum*); Boiteau & Allorge-Boiteau (1995: 90, as *K. tubiflora*). **Fig. XVIII.b**

≡ *Bryophyllum delagoense* (Ecklon & Zeyher) Schinz (1900); **incl.** *Bryophyllum tubiflorum* Harvey (1862) ≡ *Kalanchoe tubiflora* (Harvey) Hamet (1912); **incl.** *Kalanchoe verticillata* Scott Elliot (1891) ≡ *Bryophyllum verticillatum* (Scott Elliot) A. Berger (1930); **incl.** *Geaya purpurea* Costantin & Poisson (1908).

[2] Robust biennials or ± perennials, completely glabrous, 0.2 - 2 m tall, often growing in dense stands; stems simple, erect, terete; **L** ternate to apparently opposite or alternate, sessile, usually straight, erect to spreading, subcylindrical, ± grooved above, 1 - 13 cm × 2 - 6 mm Ø, reddish-green to grey-green with reddish-brown spots, tip with 2 - 9 small teeth with numerous bulbils, base attenuate; **Inf** compact many-flowered rounded thyrses, 10 - 25 cm; **Ped** slender, 6 - 20 mm; **Fl** pendent; **Cal** campanulate, reddish to green striped with red, tube 2.5 - 6 mm, lobes triangular-lanceolate, very acute, 5 - 10 × 3.7 - 5.7 mm; **Cl** red, violet, pale orange to yellow suffused with red, tube funnel-shaped, 22 - 40 mm, lobes oblong-obovate, obtuse or truncate, spreading, 7 - 12 × 6 - 9 mm; **St** inserted below the middle of the **Cl** tube, all included; **Anth** ovate, 2 - 2.5 mm; **NSc** semicircular to square, tip rounded, 0.7 - 2 mm; **Ca** ovate-oblong, 5.5 - 6.5 mm; **Sty** 19 - 20 mm; **Se** 0.6 - 2.5 mm.

This is an easily growing and, due to the abundantly produced bulbils, rapidly propagated plant. It is frequently encountered naturalized in warm climates. In most of the literature and almost throughout cultivation, this taxon is still found under the later synonym *K. tubiflora*.

K. densiflora Rolfe (BMI 1919: 263, 1919). **T:** Kenya (*Snowden* 556 [K, BM]). – **D:** C and E Africa. **I:** FPA 28: t. 1089, 1950; Gilbert (1989: fig. 88.8).

[1] Perennials 0.3 - 3 m tall; stems erect, robust, glabrous; **L** petiolate, light green, glabrous, petiole flattened and grooved above, to 3 cm, lamina oblong, ovate or subcircular, to 18 × 10 cm, tip obtuse, base cuneate, margins crenate; **Inf** densely flowered paniculate cymes, 30 - 70 cm; **Ped** 1 - 4 mm, conspicuously thickened below the **Fl**, glabrous or rarely pilose; **Fl** erect; **Cal** tube 0.1 - 0.3 mm, lobes triangular-subulate, long-attenuate, 2 - 8 × 1 - 1.5 mm, glabrous or rarely pilose; **Cl** tube 8 - 12 mm, pale to greenish-yellow, lobes oblong-lanceolate to broadly obovate, truncate or retuse, mucronate, 2 - 5 × 1.5 - 4 mm, yellow to dark orange, reddish-orange or red; **St** included; **Anth** broadly oblong, 0.7 - 0.9 mm, with apical **Gl**; **NSc** linear-subulate, 1 - 3.5 mm; **Ca** linear-lanceolate in sideview, 5 - 9 mm; **Sty** 1 - 3.5 mm.

K. densiflora var. **densiflora** – **D:** C and E Africa; glades and margins of upland forest, bush and open grassland, banks of rivers etc., 1000 - 3000 m.

Incl. *Kalanchoe glaberrima* Volken (1905) (*nom. inval.*, Art. 32.1c); **incl.** *Kalanchoe bequaertii* De Wildeman (1923).

[1] **L** lamina to 18 × 10 cm; **Cal** lobes 3 - 8 mm; **Cl** yellow, rarely orange and red, tube 9 - 12 mm, lobes broadly obovate, as long as wide or only a little longer.

K. densiflora var. **minor** Raadts (Willdenowia 8: 125-126, 1977). **T:** Kenya (*Rauh* Ke488 [BJ]). – **D:** S Kenya; edge of bush and forest, mostly on rocky ground, 2000 - 2700 m.

[1] **L** lamina to 9 × 5 cm; **Cal** lobes 2 - 3 mm; **Cl** orange-red, tube 8 - 9 mm, lobes oblong or slightly obovate, longer than wide.

K. dinklagei Rauh (KuaS 36(7): 146-150, ills., 1985). **T:** Madagascar (*Anonymus* s.n. ex cult. *BG Heidelberg* 8086 [HEID]). – **D:** SE Madagascar; xerophytic bush on sandy soils. **Fig. XVIII.c**

Incl. *Kalanchoe millotii* var. *breviseipala* Humbert (1933) ≡ *Kalanchoe brevissepala* (Humbert) Allorge-Boiteau (1995).

[1] Little trees to 8 - 10 m tall, branched from the base; stems thick, young covered with dense greyish or reddish-brown **Ha**, later with greyish bark; **L** petiolate, fleshy, thick, tough, green-whitish to whitish-silvery, clothed with stellate **Ha**, petiole widened, grooved above, 1 - 2 cm, lamina ovate, ovate-spatulate, 3 - 6 × 2.5 - 4 cm, tip obtuse, rounded to subtruncate, base attenuate, margins entire; sometimes young **L** ovate, oblong-deltoid, elliptic to oblong, margins sinuate to coarsely dentate; **Inf** dense many-flowered thyrses to 30 cm; peduncle to 20 cm, hairy; **Ped** fleshy, ± 3 mm, pilose; **Fl** erect to spreading, yellow-green to whitish; **Cal** tubular, pale green, densely pilose, tube 3 - 4 mm, lobes deltoid, 5 - 8 × ± 3 mm; **Cl** green-yellow, white-yellowish, pink, densely pilose (with stellate and sometimes glandular **Ha**), tube cylindrical, 10 - 15 mm, lobes lanceolate, ± spreading, 2.5 - 3.5 × 1 - 2 mm; **St** inserted above the middle of the **Cl** tube, slightly exserted; **Anth** ovate, 0.5 - 0.8 mm; **NSc** rectangular, ± 0.8 × 0.6 mm; **Ca** oblong, 8 - 10 mm; **Sty** 5 - 6 mm.

Together with the similar *K. arborescens* one of the largest species of *Kalanchoe*. It shows an important polymorphism in its leaves: The first-formed leaves (of young plants, basal offsets of older plants, or of cuttings) are long and incised, while later-formed leaves (of older branches etc.) are spatulate and have an entire margin. The type material of *K. dinklagei* derives from the same original collection as the type of *K. millotii* var. *breviseipala*.

K. dixoniana Hamet (BMI 1914: 281, 1914). **T:**

Thailand (*Kerr* 2876 [not located]). – **D**: Thailand; rocks, 1600 - 1800 m.

[1] Perennials (?); stems simple, erect, stout, glabrous; **L** petiolate, glabrous, petiole ± 2.3 mm, thick, lamina obovate, $\pm 11 \times 3.2$ cm, tip obtuse, base attenuate, margins slightly crenate; **Inf** corymbiform, few-branched; peduncle very short; **Ped** ± 1 cm; **Cal** pilose, subcampanulate, tube ± 1.3 mm, lobes subdeltoid, acute, acuminate, $\pm 5.5 \times 2.5$ mm; **Cl** white, subtubular, widened below the middle, tube ± 12 mm, lobes ovate-lanceolate, cuspidate, $\pm 7.5 \times 3.2$ mm; **St** inserted above the middle of the **Cl** tube, exserted; **NSc** linear, emarginate, $\pm 2.6 \times 0.6$ mm; **Ca** ovate-lanceolate, ± 8 mm; **Sty** ± 2.3 mm.

Insufficiently known, close to *K. craibii* and perhaps also to *K. grandiflora*.

K. dyeri N. E. Brown (Gard. Chron., ser. 3, 35(1): 354, 1904). **T**: Malawi (*Anonymus* s.n. [K]). – **D**: Malawi. **I**: CBM 60: t. 7987, 1904.

[1] Perennials, entirely glabrous, 60 - 75 cm tall; stems erect, terete, stout, glaucous; **L** petiolate, fleshy, petiole flattened and canaliculate above, semi-amplexicaul, 3.8 - 7.5 cm, lamina elliptic or ovate, green above, glaucous beneath, 5 - 19 $\times$ 3 - 11 cm, tip obtuse to acute, base rounded or cuneate, margins irregularly crenate-dentate; **Inf** dense corymbose cymes, 22 - 30 cm; **Ped** 16 - 19 mm; **Cal** tube 1 - 2 mm, lobes oblong, obtuse to acute, separated by rounded sinuses, 6 - 12 $\times$ 1 - 4 mm; **Cl** tube somewhat 4-angled at the base, attenuate above, pale green, 43 - 50 mm, lobes lanceolate to elliptic, acute, pure white, spreading, 18 - 25 $\times$ 9.5 - 15 mm; **St** inserted above the middle of the **Cl** tube, upper **St** exserted; **Anth** 1 - 2 mm; **NSc** linear, $\pm$ bifid, white, ± 10 mm; **Ca** 16 - 22 mm; **Sty** 22 - 24 mm.

Very close to and perhaps not specifically distinct from *K. quartiniana*.

K. elizae A. Berger (Monatsschr. Kakt.-kunde 13: 69, 1903). **T**: ex cult., not located. – **D**: Malawi, Moçambique; rocks in desert. **I**: CBM 131: t. 8036, 1905, as *Cotyledon insignis*.

Incl. *Cotyledon insignis* N. E. Brown (1905) = *Kalanchoe insignis* (N. E. Brown) N. E. Brown (1931); **incl.** *Cotyledon elizae* A. Berger ms. (1910) (*nom. inval.*, Art. 32); **incl.** *Kalanchoe laurensii* Hammet (1963).

[1/2] Perennials, completely glabrous, 0.2 - 1.8 m tall; stems 1 to few, terete, erect, stout, red or pale green; **L** shortly petiolate to subsessile, green, petiole to 15 mm, lamina broadly obovate, oblong, spatulate or suborbicular, 6.5 - 21 $\times$ 2.5 - 12 cm, tip rounded or obtuse, base rounded to cuneate, margins subcrenate, undulate or entire; **Inf** lax pyramidal panicles, 9 - 28 cm; **Ped** 4 - 18 mm; **Fl** $\pm$ pendent or spreading, slightly zygomorphic; **Cal** campanulate, dark red, tube 1.5 - 2.7 mm, lobes triangular to lanceolate, acute, 8 - 10 $\times$ ± 3 mm; **Cl** dark yellow or yellow-orange to red, tube subcy-

lindrical, obscurely 4-angled, curved upwards, 21.5 - 45 mm, lobes lanceolate or ovate-oblong, asymmetrical towards the tips, 10 - 16 $\times$ 3.5 - 7 mm; **St** inserted near the middle (just above or just below) of the **Cl** tube, exserted; **Anth** oblong to ovate, 1.5 - 2 mm; **NSc** linear-oblong, bilobed or truncate at the tip, 1.6 - 6 $\times$ ± 2 mm; **Ca** ovate-lanceolate, 10 - 15 mm; **Sty** 15 - 30 mm.

A very interesting and well-characterized species with large flowers presenting a slight zygomorphism, with a curved corolla tube, asymmetrical corolla lobes and curved filaments.

K. xena hort. ex Schneider (Rev. Hort. 14: 22, 1914).

[1] Shrublets to 30 cm tall; stems glabrous; **L** glabrous, fleshy, petiole to 2.5 cm, lamina ovate, tip obtuse, base obtuse, margins crenate, to 8 $\times$ 4.5 cm; **Inf** corymbose, many-flowered, glabrous; **Ped** to 1 cm; **Fl** scented; **Cal** green, lobes lanceolate, acuminate, $\pm 7 \times 2 - 3$ mm; **Cl** tube green, inflated at the base, ± 1 cm long, throat orange, lobes dark red, lanceolate, acute, 5 - 6 $\times$ 2 - 3 mm; **St** included; **NSc** linear, ± 3 mm; **Ca** conical.

Garden hybrid *K. grandiflora* $\times$ *K. glaucescens* (as *K. flammea*), obtained in England before 1914. It resembles *K. glaucescens* in growth and habit, while inflorescence and flowers are reminiscent of *K. grandiflora*.

K. eriophylla Hilsenberg & Bojer ex Tulasne (Ann. Sci. Nat. Bot., sér. 4, 8: 149, 1857). **T**: Madagascar (*Bojer* s.n. [P]). – **D**: C Madagascar; on rocks. **I**: Boiteau & Allorge-Boiteau (1995: 169); Rauh (1995a: figs. 385-386).

Incl. *Cotyledon pannosa* Baker (1881).

[1/2] Dwarf perennials, much-branched from the base, forming dense mats, all parts very densely covered with a whitish or $\pm$ pinky felt of long stellate **Ha**; stems simple, slender, subwoody, decumbent, 2 - 5 cm long; **L** sessile, very thick, very fleshy, connate at the base, long-ovate, obovate to subcylindrical, 1.5 - 3.5 $\times$ 1.2 - 1.5 cm, tip obtuse, margins entire; **Inf** 2- to 7-flowered cymes; peduncle to 20 cm; **Ped** 7 - 8 mm; **Fl** erect or spreading; **Cal** densely hairy, tube 1.5 - 2 mm, lobes deltoid, acute, 2 - 4 $\times$ 2.4 - 3.1 mm; **Cl** campanulate, pink, violet to blue-violet, hairy, tube 4 - 6.5 mm, lobes obovate, obtuse, 5 - 10 $\times$ 4 - 8 mm; **St** inserted below the middle of the **Cl** tube, slightly exserted; **Anth** reniform, ± 0.3 mm; **NSc** linear, emarginate, ± 1.7 mm; **Ca** 3 - 4 mm; **Sty** 1 - 1.5 mm; **Se** obovate.

A very attractive and ornamental plant. The erect flowers and the calyx place this taxon in Sect. *Kalanchoe* but the low point of insertion of the stamens indicates Sect. *Bryophyllum*.

K. fadeniorum Raadts (Willdenowia 9: 285-287, ill., 1979). **T**: Kenya, Kwale Distr. (*Faden & Faden* 77/777 [B]). – **D**: SE Kenya; semi-evergreen thickets on sandy soils, 360 m. **Fig. XVIII.e**

[1] Glabrous perennial (?) herbs ± 10 cm tall; stems decumbent, branched, erect stem parts densely leafy; **L** subsessile to shortly petiolate, fleshy, green, petiole semi-amplexicaul, to 5 mm, lamina suborbicular, broadly ovate or obovate, $1.5 - 5 \times 1.3 - 4$ cm, tip obtuse, base attenuate, margins entire or serrate-crenate; **Inf** compound cymes to 6 - 7 cm long and wide; **Ped** 3 - 4 mm; **Fl** erect; **Cal** tube ± 0.5 mm, lobes triangular, $2 - 2.5 \times \pm 1$ mm; **Cl** pale reddish-yellow-brown in the lower part, reddish above, tube cylindrical, somewhat 4-angled and slightly inflated below the middle, 13 - 14 mm, lobes elliptic, $9 - 10 \times 3.5 - 4$ mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** oblong, ± 0.7 mm, with globose apical **Gl**; **NSc** linear, 2 - 2.5 mm; **Ca** stipitate for 1 - 1.5 mm, cylindrical-lanceolate, 10 - 11.5 mm; **Sty** ± 2 mm; **Se** oblong-ovoid, ± 0.6 mm.

K. farinacea Balfour *fil.* (Proc. Roy. Soc. Edinburgh 11: 512, 1882). **T** [syn]: Socotra (*Schweinfurth* 753 [K]). – **D**: Socotra; common on limestone plains in crevices, 100 - 400 m. **I**: FPA 34: t. 1329, 1960; Miller & Cope (1996: 476, fig. 91C). **Fig. XVIII.d**

[1] Perennials, entirely glabrous, to 30 cm tall; stems terete, erect, stout, sparingly branched, white or whitish-green, bark scaly and peeling when dry; **L** crowded towards the **Br** tips, sessile, very thick, spreading, obovate to orbicular, $2 - 5.5 \times 1.5 - 3.5$ cm, surface farinaceous, covered with a white to whitish-green mealy pubescence, tip rounded, base attenuate, margins entire and faintly rosy; **Inf** compact corymbose panicles, mealy-pubescent; **Ped** 12 - 14 mm; **Fl** erect or spreading; **Cal** tube ± 1 mm, lobes triangular, fleshy, $1 - 2 \times 1 - 1.5$ mm; **Cl** bright red, tube uniformly cylindrical, 10 - 15 mm, lobes ovate-oblong, acute, apiculate, ± 4 mm, spreading; **St** inserted at the throat of the **Cl** tube, upper **St** exserted; **Anth** broadly oblong; **NSc** linear-oblong, rounded at the tip, ± 2 mm; **Ca** narrowly oblong, 4 - 8 mm; **Sty** ± 4 mm.

Closely resembling *K. scapigera* (endemic to Angola), but different esp. in flower colour.

K. fedtschenkoi Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 3: 75-80, 1915). **T**: Madagascar (*Perrier* 11797 [P]). – **D**: C and SE Madagascar; siliceous rocks, 100 - 1000 m, naturalized in some tropical countries (e.g. India). **I**: Boiteau & Allorge-Boiteau (1995: 103); Rauh (1995a: figs. 387-389). **Fig. XVIII.f**

$\equiv$ *Bryophyllum fedtschenkoi* (Hamet & H. Perrier) Lauzac-Marchal (1974); **incl.** *Kalanchoe fedtschenkoi* var. *isalensis* Boiteau & Mannoni (1949); **incl.** *Kalanchoe fedtschenkoi* var. *typica* Boiteau & Mannoni (1949) (*nom. inval.*, Art. 24.3).

[2] Perennials, entirely glabrous, tuft-forming, to 50 cm tall; stems thin, often purple, much branched, initially prostrate, creeping and easily rooting, later

ascending to erect; **L** densely arranged, fleshy, flat, shortly petiolate for 1 - 6 mm, lamina obovate-subcircular, obovate or obovate-oblong, $1 - 5 \times 0.5 - 2.5$ cm, covered with a glaucescent purple waxy bloom, tip rounded, base cuneate, margins often red-purple, crenate and coarsely dentate in upper $\frac{1}{2}$, sometimes with bulbils; **Inf** lax corymbs to 20 cm; **Ped** 7 - 10 mm; **Fl** pendent; **Cal** yellow-green with numerous red, purple to blue lines, tube 12 - 14 mm, lobes deltoid, acutely acuminate, $6 - 7 \times 6 - 6.5$ mm; **Cl** subtubular to subcampanulate, orange-red with numerous red lines, tube 17 - 19 mm, lobes obovate, obtuse, $6 \times 4.2 - 4.6$ mm; **St** inserted $\pm$ at the middle of the **Cl** tube, upper **St** exserted; **Anth** subreniform, ± 1 mm; **NSc** $\pm$ semi-orbicular, 0.8 - 1 mm; **Ca** 9 - 10 mm; **Sty** 13 - 15 mm; **Se** obovate, ± 0.6 mm.

Very variable as to growth form and size, leaf margin indentations and colour of various plant parts. Frequently encountered in cultivation, together with its cultivar 'Variegata' with whitish-yellowish variegated leaves.

K. $\times$ felthamensis Hort. Veitch *ex* Mottet (Rev. Hort. 11: 348-349, 1911).

$=$ *K. flammea* (*K. glaucescens*) $\times$ *K. kirkii* (*K. lateritia*) hybrid created in 1903 in England by Veitch. Plants elegant, vigorous, of rapid growth; **L** brown-green, bronze-tinted, margin slightly crenulate; **Inf** many-flowered; **Fl** colour brilliant as in *K. glaucescens*, orange-yellow to pink, vermillion, crimson or scarlet.

K. fernandesii Hamet (Bol. Soc. Brot., sér. 2, 24: 107-113, 1950). **T**: Moçambique, Niasa Prov. (*Torre* 907 [COI]). – **D**: Moçambique.

This is perhaps a variety of *K. lateritia* or a hybrid *K. lateritia* $\times$ *K. lanceolata* (Fernandes 1983: 51).

K. garambiensis Kudo (J. Soc. Trop. Agric. 2: 235, 1930). **T**: Taiwan (*Kudo* & *Mori* 16132 [not located]). – **D**: China, Taiwan; rocks at the seashore.

[1] Small herbs, entirely glabrous, 5 - 8 cm tall; **L** petiolate, fleshy, lamina spatulate, $1 - 2.8 \times 0.3 - 1.3$ cm, tip rounded, mucronate, base narrowly attenuate towards the petiole, margins entire; **Inf** lax 3- to 10-flowered corymbose cymes; **Cal** lobes ovate-oblong, acute, glandular, ± 5 mm; **Cl** yellow, tube slender, urceolate at the base, ± 20 mm, lobes broadly orbicular-ovate, obtuse, retuse or slightly acute.

Very ill-known species, probably annual and very rare.

K. gastonis-bonnieri Hamet & H. Perrier (Ann. Sci. Nat. Bot., sér. 9, 16: 364-366, 1912). **T**: Madagascar (*Perrier* 11831 [P]). – **D**: NW Madagascar; rocky places. **I**: Boiteau & Allorge-Boiteau (1995: 117, pl. 4: 1,4); Rauh (1995a: figs. 999-1005); Descouings (1997b). **Fig. XIX.a**

≡ *Bryophyllum gastonis-bonnieri* (Hamet & H. Perrier) Lauzac-Marchal (1974); **incl.** *Kalanchoe adolphi-engleri* Hamet (1955); **incl.** *Kalanchoe gastonis-bonnieri* var. *ankaiziniensis* Boiteau ex Allorge-Boiteau (1995); **incl.** *Kalanchoe ankaiziniensis* Boiteau (1995) (*nom. inval.*, Art. 34.1c).

[2] Perennials or sometimes biennials with basal **Ros**; stems usually very short, glabrous; **L** petiolate, very thick, fleshy, whitish-pruinose above, green with numerous irregular brownish-green spots, glabrous, petiole broad, amplexicaul, 3.5 - 6.5 cm, lamina ovate-lanceolate, 13 - 50 × 4.5 - 10 cm, folded lengthwise like a gutter, tip long-acute with bulbils, base cuneate, margins coarsely crenate; **Inf** lax ± many-flowered corymbs, 20 - 30 cm; peduncle 30 - 50 cm; **Ped** ± 1 cm; **Fl** pendent or ± spreading; **Cal** glabrous, green with red or violet lines, tube cylindrical, 13 - 16 mm, lobes deltoid, acute, 5 - 6 × 4.2 - 5.3 mm; **Cl** yellow-green with red or violet lines, finely glandular-hairy, tube cylindrical, ± 30 mm, lobes orbicular, acuminate, 9 - 11 × 5.5 - 7.5 mm; **St** inserted towards the base of the **Cl** tube, upper **St** slightly exserted; **Anth** reniform, 2.5 - 3 mm; **NSc** square, emarginate, 1.2 - 2 mm; **Ca** 9 - 11 mm; **Sty** 16 - 24 mm; **Se** obovate, ± 0.8 mm.

A beautiful species with very attractive flowers. There is no doubt that it belongs to Sect. *Bryophyllum*, but some authors continue its erroneous placement in Sect. *Kalanchoe*, e.g. Rauh (1995a).

K. germanae Hamet ex Raadts (Willdenowia 13 (2): 377, 1983). **T**: Tanzania, Masai Distr. (*Bally* X40 [EA]). – **D**: N Tanzania; dry rocky places on volcanic soils, 1000 - 1800 m. **I**: Hamet (1931-1963: 2: tt. 23-24, 1956).

[1] Perennials, glabrous, pruinose, 0.2 - 1 m tall; **L** petiolate, petiole terete, not dilated at the base, to 4 cm, lamina lanceolate-elliptic, upper **L** sometimes 3-lobed or 3-foliolate, glaucous or grey-green, dark purple-spotted beneath, middle **L** 7.5 - 15 × 2.5 - 5.5 cm, tip acute, base cuneate, margins deeply crenate-serrate; **Inf** paniculate cymes, 10 - 30 cm; **Ped** 5 - 20 mm; **Fl** erect; **Cal** tube 1 - 2 mm, lobes narrowly lanceolate, 8 - 15 × 2 - 3 mm; **Cl** creamy-white or yellow, tube 19 - 27 mm, lobes lanceolate, long-acuminate, 10 - 16 × 4 - 6 mm; **St** inserted above the middle of the **Cl** tube, upper **St** exserted; **Anth** oblong, 1.3 - 2 mm, with apical **Gl**; **NSc** linear, 5 - 7.5 × ± 2 mm; **Ca** slender, 10 - 15 mm; **Sty** 7 - 10 mm.

K. glaucescens Britten (FTA 2: 393-394, 1871). **T** [lecto]: Ethiopia (*Schimper* 724a [B, K]). – **D**: C and E Africa, Sudan, Ethiopia, Somalia, Arabia; dry open bushland and grassland, thickets, stony hillsides, riverine bushland etc., 550 - 2100 m. **I**: Troupin (1978: fig. 71); Gilbert (1989: fig. 88.8).

Incl. *Kalanchoe glaucescens* ssp. *glaucescens*; **incl.** *Kalanchoe holstii* Engler (1895); **incl.** *Kalanchoe flammea* Stapf (1897); **incl.** *Kalanchoe magni-*

dens N. E. Brown (1905); **incl.** *Kalanchoe marinellii* Pampanini (1909); **incl.** *Kalanchoe beniensis* De Wildeman (1923); **incl.** *Kalanchoe elliptica* Raadts (1972).

[1] Perennials, glabrous, pruinose, 0.3 - 1.2 m tall; stems erect or decumbent at the base; **L** petiolate, petiole slightly flattened and grooved above, 0.5 - 2.5 cm, easily detachable from the stem, lamina narrowly to broadly ovate, obovate, glaucous or glaucescent, sometimes with maroon or purple spots beneath, to 10 × 7 cm, tip acute to obtuse, base cuneate, margins bluntly serrate to crenate, rarely subentire; **Inf** paniculate cymes, ± 25 cm; **Ped** 2 - 8 mm; **Fl** erect; **Cal** tube 0.2 - 1 mm, lobes linear-lanceolate to linear-subulate, 2 - 6 × 1 - 2 mm; **Cl** orange-yellow to pink, vermillion, crimson or scarlet, greenish in lower part, tube 5 - 14 mm, lobes lanceolate-ovate, acute, mucronate, 3 - 6.5 × 1 - 2.5 mm; **St** included; **Anth** oblong, 0.6 - 0.9 mm, with apical **Gl**; **NSc** linear, 2 - 3.5 mm; **Ca** linear-lanceolate in sideview, 4.5 - 10 mm; **Sty** 1 - 2 mm.

Raadts (1977) has described a hybrid between *K. glaucescens* and *K. nyikae* ssp. *auriculata* from Kenya.

K. globulifera H. Perrier (Arch. Bot. Bull. Mens. 2(2): 25-26, 1928). **T**: Madagascar (*Perrier* 16222 [P]). – **D**: N Madagascar; shady rocks or epiphytic, 2400 m.

Incl. *Kalanchoe globulifera* var. *blossfeldiana* Boiteau ex Allorge-Boiteau (1995) (*nom. inval.*, Art. 32.1c); **incl.** *Kalanchoe globulifera* var. *typica* Boiteau & Allorge-Boiteau (1995) (*nom. inval.*, Art. 32.1c).

[1] Small perennials, irregularly branched from the base, stoloniferous; stems short, slender, prostrate, decumbent, glandular-hairy, tip with 3 - 4 pairs of **L** forming a **Ros**; **L** subsessile, glabrous, lamina ovate to obovate-spatulate, 14 - 28 × 13 - 18 mm, tip rounded, base cuneate, narrowed into the very short petiole, margins ± dentate in the upper part; **Inf** few-flowered capitulate corymbs, 10 - 15 cm; peduncle 8 - 10 cm, rather long glandular-hairy; **Ped** glabrous, ± 3 mm; **Fl** erect; **Cal** lobes almost free, linear, rounded at the tip, ± 4 mm; **Cl** yellow, glabrous, tube cylindrical, ± 8 mm, lobes ovate, obtuse, ± 3 × 2 mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** globose, ± 0.4 mm, with a big sessile **Gl** at the tip; **NSc** linear, tip 2-furcate, ± 3.5 mm; **Ca** 4 - 5 mm; **Sty** ± 1 mm; **Se** ± 0.5 mm.

Close to *K. boisii*, *K. bouvetii* and *K. chapototii*.

K. gracilipes (Baker) Baillon (Bull. Mens. Soc. Linn. Paris 1(59): 469, 1885). **T**: Madagascar (*Kitching* s.n. [K, P]). – **D**: C and E Madagascar; epiphytic in rain forest. **I**: Boiteau & Allorge-Boiteau (1995: 43); Rauh (1995a: figs. 288, 390-392). **Fig. XVIII.h**

≡ *Kitchingia gracilipes* Baker (1881) ≡ *Bryophyl-*

lum gracilipes (Baker) Eggli (1992); **incl.** *Kalanchoe gracilipes* var. *microphylla* Humbert ex Allorge-Boiteau (1995).

[2/1] Perennial epiphytes, entirely glabrous, with slender flexuose stems from a decumbent base, pendent, to 60 cm, with fibrous **R** from the lower nodes; **L** green, petiolate, petiole terete, 6 - 22 mm, lamina oblong, ovate to ovate-orbicular, 1 - 3 × 0.5 - 2 cm, tip obtuse, base cuneate, margins deeply crenate; **Inf** lax 2- to 6-flowered corymbs; **Ped** very slender, 12 - 20 mm; **Fl** pendent; **Cal** green, tube 2 - 3 mm, lobes ovate to semi-orbicular, 2.5 - 3.5 × 3.5 - 4.5 mm; **Cl** urceolate, bright red, orange-red, yellow, yellow-green or light pink, tube 20 - 25 mm, lobes ovate to semi-orbicular, obtuse, ± 4 × 6 mm; **St** inserted in the upper part of the **Cl** tube, included; **Anth** black, globose; **NSc** rectangular, 1 - 1.6 × ± 1 mm; **Ca** oblong, 8 - 12 mm; **Sty** 18 - 20 mm; **Se** oblong, ± 1.6 mm.

This attractive species is one of the rare epiphytes in the genus, having its home in shady rain forests with high air humidity. It is intermediate between Sect. *Kalanchoe* (stamens inserted above the middle of the corolla tube) and Sect. *Bryophyllum* (calyx, pendent flowers) but belongs to the latter.

K. grandidieri Baillon (in Grandidier, Hist. Phys. Madagascar 28: 2(Atlas 1): t. 57, 1888). **T:** Madagascar (*Grandidier* 4514 [P]). – **D:** SW Madagascar (Mahafaly Plateau); on limestone. **I:** Boiteau & Allorge-Boiteau (1995: pl. 7: 17-18).

Incl. *Sarcocaulon curralii* Heckel (1908); **incl.** *Kalanchoe delescurei* Hamet ex H. Perrier (1923).

[1] Perennial shrubs, very stout, to 3 m tall, entirely glabrous; stems erect, thick, to 2 - 7 cm Ø, ± branched, whitish, with resinous bark; **L** sessile, very fleshy, to 1 cm thick, hard and heavy, oblong, obovate to spatulate, carinate, 4 - 15 × 2 - 7 cm, tip obtuse, acutely mucronate, base attenuate, margins entire; **Inf** narrow thyrses, 20 - 50 cm; peduncle 40 - 60 cm; **Ped** fleshy, 6 - 8 mm; **Fl** tough, erect to nodding; **Cal** green, campanulate, tube 1 - 3.5 mm, lobes widely triangular, acute, 1 - 4 mm long and wide; **Cl** violet, fleshy, tube urceolate, sharply 4-angled, 12 - 25 × 7 - 10 mm Ø, lobes ovate, acutely mucronate, margins membranous, 4 - 7.5 × 4 - 5.5 mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** ovate, yellow, ± 2 mm; **NSc** ± rectangular, ± 2 mm; **Ca** ovate-oblong, 9 - 12 mm; **Sty** 5 - 6 mm; **Se** oblong, 3 - 4 mm.

This very beautiful species belongs to the larger-growing members of *Kalanchoe*. Despite its slow growth, it is easy to cultivate and can be propagated from individual leaves.

K. grandiflora Wight & Arnott (Prodr. Fl. Ind. Orient., 359, 1834). **T:** India (*Wallich* 7226 [K?]). – **D:** India; slopes, rocky ground with poor soil, 1000 - 2000 m. **I:** CBM t. 5460, 1864; Berger (1930: fig. 185K-L, 196A-C).

[1] Perennials, entirely glabrous, 0.6 - 1 m tall; stems erect, to 2.5 cm Ø, branched; **L** sessile to subsessile, fleshy, upper **L** frequently tinged with red, broadly obovate, obovate to subrhomboidal, 4 - 7.5 × 3 - 3.5 cm, with 3 principal longitudinal veins, blue-violet, bluish-green or glaucous, with easily removed waxy coating, tip obtuse to rounded, base attenuate, margins crenate-dentate; **Inf** subsessile lax many-flowered corymbose panicles; **Ped** 12 - 18 mm; **Fl** erect or spreading, light yellow to green-yellow; **Cal** tube 2.5 - 3 mm, lobes ovate-lanceolate to oblong, acute, reflexed, ± 6 mm; **Cl** tube 4-angled, swollen at the base and bottle-shaped, 12 - 14 mm, lobes ovate to obovate, obtuse, abruptly long-mucronate, reflexed, ± 12 × 4 mm; **St** inserted in the upper part of the **Cl** tube, exserted; **Anth** oblong, with minute capitulate appendage; **NSc** linear, ± 4 mm; **Ca** oblong, ± 4 mm; **Sty** ± 4 mm.

K. hametiorum Hamet (Bol. Soc. Brot., sér. 2, 37: 25, pl. 3, 1963). **T:** Moçambique (*Torre* 1513 [COI, LISC]). – **D:** Moçambique; rocks, 200 - 320 m. **I:** Hamet & Marnier-Lapostolle (1969: pl. 1).

[1] Perennials, 0.2 - 1.5 m tall, covered everywhere with a dense brownish indumentum; stems simple, terete, erect, straight, pilose; **L** opposite or rarely alternate, sessile, fleshy, linear or oblong to narrowly elliptic, 4.5 - 11 × 0.4 - 2.7 cm, pilose, tip obtuse to subacute, base attenuate, subamplexicaul, margins entire, sinuate or shallowly crenate; **Inf** few-flowered corymbose cymes, 3 - 12 cm; **Ped** 3.5 - 11 mm; **Fl** erect; **Cal** green to yellowish-green, hairy outside, glandular-hairy inside, tube fusiform-urceolate, 5.5 - 8 mm, lobes deltoid, lanceolate to subovate, acute, 5 - 10 × 2.3 - 3.5 mm, fleshy; **Cl** yellowish to salmon, shortly glandular-hairy, tube cylindrical-urceolate, obtusely 4-angled, 9 - 11 mm, lobes oblong-lanceolate to subovate, acute, 3.5 - 5.8 × ± 1.7 mm, erect to spreading; **St** inserted above the middle of the **Cl** tube, included or almost so; **Anth** ovate-oblong, ± 1 mm; **NSc** linear, emarginate, 1.3 - 2 × ± 0.3 mm; **Ca** oblong, 6 - 8 mm; **Sty** 1.6 - 2.5 mm; **Se** subovoid, 0.5 mm.

K. hildebrandtii Baillon (Bull. Mens. Soc. Linn. Paris 1(59): 468, 1885). **T:** Madagascar, Prov. Imérina (*Hildebrandt* 3684 [P, LE]). – **D:** S and SW Madagascar; xerophytic bush on various soils and rocks. **I:** Hamet & Marnier-Lapostolle (1964: fig. 75); Boiteau & Allorge-Boiteau (1995: 145). **Fig. XIX.b**

Incl. *Kalanchoe gomphophylla* Baker (1887); **incl.** *Kalanchoe hildebrandtii* var. *glabra* Rauh & Hedding (1997).

[1] Perennial branched shrubs, to 1 - 4 m tall, entirely and ± densely covered with minute stellate **Ha** (with 3 bifid or multifid branches), **Ha** very appressed and giving the plants a glabrous appearance; stems woody, erect, strongly branched; **L** petiolate, glaucous to greenish, petiole cylindrical,

canaliculate, 3 - 8 mm, lamina thick, tough, ovate to roundish, 1.5 - 5 × 1 - 3.5 cm, tip obtuse to rounded, base suddenly cuneate, margins entire; **Inf** lax panicles, 8 - 35 cm; **Ped** 1.5 - 4 mm; **Fl** erect, fleshy; **Cal** green, tube ± 0.5 mm, lobes ± deltoid, acute, 1.2 - 2.5 mm long and wide; **Cl** white, pale green to yellow, urceolate, sparingly hairy, tube 3 - 5 mm, lobes ovate, obtuse, 2.2 - 3.6 × 1.6 - 2 mm; **St** inserted just above the middle of the **Cl** tube, included or slightly exserted; **Anth** reniform, 0.3 - 0.4 mm; **NSc** ± rectangular, 1 - 1.5 mm; **Ca** 2.5 - 5 mm; **Sty** 0.8 - 1.5 mm; **Se** obovate.

The recently described var. *glabra*, here tentatively placed as synonym, appears to fall within the natural variation, which is of a similar magnitude as in *K. bracteata*.

K. humilis Britten (FTA 2: 397, 1871). **T**: Moçambique (Waller s.n. [K]). – **D**: Tanzania, Malawi, Moçambique; between rocks in crevices, 1200 - 1400 m. **I**: Hamet & Marnier-Lapostolle (1964: figs. 122-123).

Incl. *Kalanchoe prasina* N. E. Brown (1904); **incl.** *Kalanchoe figueiredoi* Croizat (1937).

[1] Perennials, completely glabrous, 0.8 - 1 m tall; stems simple or few-branched, erect or procumbent at the base, arising from a subhorizontal rhizomatous woody base; **L** sessile or subsessile, fleshy, flattish, lamina obovate to spatulate, dull pale green, sometimes tinged yellowish, with purple marks, pruinose when young, 1.5 - 13 × 1 - 6 cm, tip obtuse, rounded to subtruncate, base cuneate, margins purple, entire to obtusely crenate; **Inf** very ample many-flowered panicles, pruinose, 12 - 38 cm; **Ped** 2 - 15 mm; **Fl** erect or horizontal; **Cal** purple, tube 0.2 - 0.5 mm, lobes broadly triangular, acute, glaucous, 1 - 1.5 × 0.8 - 1 mm; **Cl** tube ± 4-angled, scarcely dilated at the base, pale greenish to lilac with purplish veins and longitudinal markings, 4.5 - 5 mm, lobes oblong, obtuse, apiculate, whitish or greenish with purplish veins, 1.7 - 3 × 1 - 2 mm; **St** inserted above the middle of the **Cl** tube, upper **St** exserted; **Anth** oblong or suborbicular, 0.6 - 1.2 mm, with stalked apical **Gl**; **NSc** linear, bifid, 1.5 - 3 mm; **Ca** oblong-lanceolate, 4.5 - 5.5 mm; **Sty** 0.5 - 1 mm.

K. integrifolia Baker (JLSB 22: 471, 1887). **T**: Madagascar (Baron 4377 [K, P]). – **D**: C-S Madagascar; siliceous rocks, 1200 - 2000 m. **I**: Hamet & Marnier-Lapostolle (1964: figs. 8-10); Rauh (1995a: figs. 524-531).

Incl. *Kalanchoe bitteri* Hamet & H. Perrier (1914) ≡ *Kalanchoe integrifolia* var. *bitteri* (Hamet & H. Perrier) Allorge-Boiteau (1995); **incl.** *Kalanchoe heckelii* Hamet & H. Perrier (1914); **incl.** *Kalanchoe integrifolia* var. *flava* Boiteau ex Allorge-Boiteau (1995).

[1] Perennials, polymorphic, profusely branched from the base forming dense tufts, 0.5 - 1 m tall;

stems woody, erect, stout, to 2 cm Ø; **L** crowded at the **Br** tips, sessile, glabrous, very thick, fleshy, tough, pruinose, waxy-grey, oblong, obovate-spatulate or subcylindrical, 3 - 11 × 0.8 - 2.5 cm, tip obtuse to cuneate, base gradually narrowed, margins entire; **Inf** small very dense panicles, 2 - 5 cm; peduncle stiffly erect, 8 - 25 cm; **Ped** fleshy, red, 2.5 - 6 mm, glandular-hairy; **Fl** erect; **Cal** green, softly glandular-hairy, tube 0.2 - 1.4 mm, lobes ovate-deltoid, 1.2 - 3.5 × ± 2 mm; **Cl** urceolate, glabrous to glandular-hairy, white, yellowish, pink to dull reddish, tube 2.5 - 5 mm, lobes oblong-obovate, 3.5 - 6 mm long and wide; **St** inserted above the middle of the **Cl** tube, included; **Anth** reniform, 0.8 - 1 mm; **NSc** linear-deltoid, 1.7 - 2.5 × 0.8 - 1.2 mm; **Ca** 3.5 - 5.5 mm; **Sty** 1.2 - 1.9 mm; **Se** obovate, ± 1.5 mm.

The leaves are polymorphic according to the age of the plants: young plants produce large ovate leaves which become progressively more cylindrical in the course of time. The flower colour changes during anthesis from white or rose-pink to yellowish. Furthermore, the shape and dimension of the corolla is variable from one individual to the next, and this also applies to the form of the calyx hairs.

K. jongmansii Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 2: 195-199, 1914). **T**: Madagascar (Perrier 11811 [P]). – **D**: C Madagascar (Andringitra Massif); rocks. **I**: Hamet & Marnier-Lapostolle (1964: figs. Q, 43-44); Rauh (1995a: figs. 393-395).

[1/2] Small perennial herbs; stems simple, slender, erect, to 30 cm, glabrous at the base, young parts ± glandular-hairy; **L** fleshy, sessile, ± erect and sometimes appressed against the stem, oblong, 0.7 - 4.5 × 0.2 - 1 cm, tip obtuse, base attenuate, margins entire to slightly crenate-dentate in upper part; **Inf** few-flowered corymbs, ± 4 cm, sometimes with small bulbils; peduncle glandular-hairy, 9 - 25 cm; **Ped** ± 4 mm; **Fl** erect; **Cal** green, tube 0.2 - 0.8 mm, lobes ovate, acute, 6 - 12 × 1.7 - 2.4 mm; **Cl** campanulate, clear to golden-yellow, tube ± 4-angled, glabrous or glandular-hairy, 9 - 14 mm, lobes ovate, cuspidate, 6 - 8 × 4 - 5 mm; **St** inserted below the middle of the **Cl** tube, included or slightly exserted; **Anth** ovate, ± 1 mm; **NSc** linear to rectangular, 1.4 - 1.6 × ± 1 mm; **Ca** 5 - 8 mm; **Sty** 3 - 4 mm; **Se** obovate, 0.5 mm long.

Very different from all other species of the genus in its *Hypericum*-like appearance, the narrow leaves and the large flowers. While placed in Sect. *Bryophyllum* by most authors, it is in fact intermediate between Sect. *Bryophyllum* (presence of bulbils, insertion of stamens) and Sect. *Kalanchoe* (erect flowers, short-tubed calyx appressed against the corolla).

K. jongmansii ssp. *ivohibensis* Humbert (Bull. Mus. Hist. Nat. (Paris) ser. 2, 5(2): 168, 1933). **T** [syn]: Madagascar (Humbert 3218 [P]). – **D**: C Ma-

dagascar (Pic d'Ivoihibé); moist siliceous rocks, 1500 - 2000 m.

[1/2] All plant parts sparsely glandular-hairy; **Fl** 25 - 30 mm; **Cl** tube 3× as long as the lobes; **NSc** narrowly linear, $\pm 2.5 \times 1.25$ mm.

K. jongmansii ssp. **jongmansii** – **D**: C Madagascar (Mt. Andringitra); moist rocky places, 2200 m. **Fig. XIX.g**

[1/2] Floriferous stems, **Ped** and **Cal** glandular-hairy; **Fl** 12 - 15 mm; **Cl** tube 2× as long as the lobes; **NSc** rectangular, 1 - 1.5 mm.

K. ×kewensis Dyer (Ann. Bot. (London) 17: 439, pl. 21-23, 1903).

[1] Perennial shrublets, glabrous, tinted bronze-green; stems erect, 90 - 120 cm tall, simple or few-branched; **L** petiolate, very decorative; basal **L** oblanceolate, tip acute, very thick, upper face grooved; middle and upper **L** subcylindrical, upper face canaliculate, tripartite, the lobes $\pm$ pinnatifid, tip $\pm$ longish-acute, olive-green tinted purple at the base; **Inf** panicles, ± 10 cm long; **Fl** long; **Cl** beautifully brilliant pink.

A garden hybrid obtained 1901 at Kew Gardens between *K. glaucescens* (as *K. flammea*) and *K. bentii*. This hybrid is frequently cultivated and easily propagated from cuttings. It is remarkable by showing characters not present in either of the parents.

K. laciniata (Linné) De Candolle (Pl. Hist. Succ. 2: t. 100, 1802). **T**: BM [herb. Clifflort]. – **D**: Morocco, E, S and SW Africa, Arabian Peninsula, S India; open bushland, scrub and margins of thickets etc., 450 - 2000 m. **I**: Hamet & Marnier-Lapostolle (1964: figs. 84-85); Gilbert (1989: 21, figs. 88.8: 5-6); Miller & Cope (1996: fig. 90E).

$\equiv$ *Cotyledon laciniata* Linné (1753) $\equiv$ *Vereia laciniata* (Linné) Willdenow (1799); **incl.** *Cotyledon heterophylla* Roxburgh (1814); **incl.** *Kalanchoe gracilis* Hance (1870); **incl.** *Kalanchoe macrosepala* Hance (1870); **incl.** *Kalanchoe brachycalyx* Engler (1892) (*nom. illeg.*, Art. 53.1); **incl.** *Kalanchoe schweinfurthii* Penzig (1893); **incl.** *Kalanchoe rohlfii* Engler (1902); **incl.** *Kalanchoe takeoi* Hayata (1919); **incl.** *Kalanchoe faustii* Font Quer (1935) $\equiv$ *Kalanchoe laciniata* ssp. *faustii* (Font Quer) Maire (1977); **incl.** *Kalanchoe lentiginosa* Cufodontis (1958); **incl.** *Kalanchoe densiflora* var. *subpilosa* Cufodontis (1965); **incl.** *Kalanchoe gloveri* Cufodontis (1965).

[1] Perennial or biennial shrublets 0.4 - 1.5 m tall; stems usually simple, terete, erect, glabrous below, $\pm$ puberulous above, reddish; **L** petiolate, fleshy, green, glabrous or often $\pm$ pubescent above, petiole flattened, canaliculate, broadened at the base or semi-amplexicaul, 2 - 9 mm, lamina very variable in shape, usually compound or dissected, 3-partite or 3-foliate to 3- to 5-pinnatifid or pinnate, some-

times entire, median **L** mostly 3-foliate or 3-partite, leaflets ovate, lanceolate to linear, tip attenuate, acute, margins crenate, dentate, coarsely serrate to laciniate, **L** segments 2 - 14 $\times$ 2.5 - 8 cm; **Inf** corymbose or paniculate flat-topped cymes, 40 - 60 cm, finely densely glandular-pubescent; **Ped** 1 - 10 mm; **Fl** erect, sparsely pubescent-glandular; **Cal** tube 0.4 - 1.5 mm, lobes triangular-lanceolate, oblong-ovate, acute, 2.5 - 5 (-7) $\times$ 1 - 2.5 mm; **Cl** cream to pale yellow, orange to salmon-pink, tube oblong-ampullaceous, 9 - 11 (-15.5) mm, lobes oblong to ovate-lanceolate, acute, mucronate 3 - 6 (-7.5) $\times$ 2 - 3.5 (-4.5) mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** ovate, 0.5 - 0.6 mm, with apical **Gl**; **NSc** linear-subulate, 2 - 4 $\times$ $\pm$ 0.3 mm; **Ca** fusiform, 5 - 12 mm; **Sty** 0.75 - 2.5 mm.

K. laciniata is a very polymorphic species, particularly as to shape and size of the leaves. It is somewhat similar to *K. lanceolata* and also resembles *K. crenata*. Ssp. *faustii* is doubtfully distinct in view of the general variability of the species. The question of its presence in Morocco being due to a possible ancient introduction remains open to debate.

K. laetivirens Descoings (J. Bot. Soc. Bot. France 4: 85, 1997). **T**: Madagascar, Toliara (*Descoings* 28234 [P]). – **D**: SW Madagascar (Isalo). **Fig. XIX.h**

[2] Pluriennials with short-stemmed **Ros**, entirely glabrous, 10 - 20 cm tall; stems simple, terete, short, 4 - 8 mm $\varnothing$; **L** petiolate, thick, fleshy, densely arranged, clear green, petiole terete, amplexicaul, 4 - 8 cm, lamina oblong to elliptic, folded lengthwise like a gutter, 7 - 15 $\times$ 4 - 7 cm, tip cuneate, base cuneate, often enlarged in 2 rounded erect auricles, margins regularly crenate with acute teeth, producing numerous bulbils; **Inf** many-flowered corymbose cymes, 10 - 20 cm; **Ped** curved, 3 - 6 mm; **Fl** pendent; **Cal** green, yellowish-green to pink, tube cylindrical, 3.5 - 4 mm, lobes deltoid, acuminate, 3 - 3.5 $\times$ 2.2 - 2.5 mm; **Cl** greenish-white, greenish-yellow tinged with pink to purplish-pink, tube cylindrical to $\pm$ 4-angled, 13 - 16 mm, lobes ovate-oblong, rounded at the tip, erect, 7 - 9 $\times$ 5 - 6 mm; **St** inserted near the base of the **Cl** tube, slightly exerted; **Anth** ovate, $\pm$ 0.8 mm; **NSc** trapezoidal, 1 - 1.2 $\times$ $\pm$ 1 mm, truncate; **Ca** oblong, 4.5 - 5.5 mm; **Sty** 14 - 18 mm.

This nice plant is frequently cultivated in Madagascar gardens and numerous collections. It is rather close to *K. daigremontiana* but differs characteristically by its habit, as well as the colour and form of its leaves.

K. lanceolata (Forsskål) Persoon (Synops. Pl. 1: 446, 1805). **T**: Yemen (*Forsskål* 689 [C]). – **D**: Widespread in tropical Africa from Guinea to Ethiopia and to RSA and Namibia, also in Madagascar, Arabia and India; in various habitats, 250 - 2000 m.

I: Hamet & Marnier-Lapostolle (1964: figs. 86-88); FPA 46: t. 1848, 1980.

≡ *Cotyledon lanceolata* Forsskål (1775) ≡ *Vereia lanceolata* (Forsskål) Sprengel (1825); **incl.** *Kalanchoe lanceolata* var. *lanceolata*; **incl.** *Kalanchoe pubescens* R. Brown (1814) (*nom. inval.*, Art. 32.1); **incl.** *Kalanchoe floribunda* Wight & Arnott (1834) ≡ *Vereia floribunda* (Wight & Arnott) A. Dietrich (1840); **incl.** *Kalanchoe brachycalyx* A. Richard (1847) ≡ *Kalanchoe laciniata* var. *brachycalyx* (A. Richard) Chiovenda (1916); **incl.** *Kalanchoe glandulosa* Hochstetter ex A. Richard (1847) ≡ *Kalanchoe lanceolata* var. *glandulosa* (Hochstetter ex A. Richard) Cufodontis (1965); **incl.** *Kalanchoe ritchieana* Dalzell (1852); **incl.** *Meristostylus macrocalyx* Klotzsch (1861); **incl.** *Kalanchoe modesta* Kotschy & Peyritsch (1867); **incl.** *Kalanchoe platysephala* Welwitsch ex Britten (1871); **incl.** *Kalanchoe glandulosa* var. *benguensis* Engler (1892); **incl.** *Kalanchoe crenata* var. *collina* Engler (1895); **incl.** *Kalanchoe pilosa* Baker (1895); **incl.** *Kalanchoe pentheri* Schlechter (1897); **incl.** *Kalanchoe glandulosa* var. *tomentosa* Keissler (1900); **incl.** *Kalanchoe goetzei* Engler (1901); **incl.** *Kalanchoe diversa* N. E. Brown (1902); **incl.** *Kalanchoe heterophylla* Prain (1903) (*nom. illeg.*, Art. 53.1); **incl.** *Kalanchoe brachycalyx* var. *erlangeriana* Engler (1904) (*nom. inval.*, Art. 32.1); **incl.** *Kalanchoe ellacombei* N. E. Brown (1912); **incl.** *Kalanchoe junodii* Schinz (1912); **incl.** *Kalanchoe homblei* De Wildeman (1913); **incl.** *Kalanchoe homblei* fa. *reducta* De Wildeman (1914); **incl.** *Kalanchoe gregaria* Dinter (1922) (*nom. inval.*, Art. 32.1?); **incl.** *Kalanchoe glandulosa* var. *rhodesica* Baker fil. ex Rendle (1932) (*nom. inval.*, Art. 32.1).

[1/2] Annuals or perennials, 0.2 - 2 m tall, glabrous or glandular-pubescent, at times viscid; stems usually simple, erect, usually 4-angled or ± narrowly winged at the base; **L** sessile, obovate to narrowly oblong, lanceolate, elliptic to ovate-spatulate, glabrous or glandular-pubescent, green or yellowish-green, 3 - 30 × 1 - 10 cm, tip acute or obtuse, base cuneate, decurrent and semi-amplexicaul, margins entire or sinuate, serrate or crenate, papery to membranous; **Inf** paniculate cymes, 35 - 50 cm, glandular-pubescent; **Ped** 1 - 10 mm, glandular-hairy; **Fl** usually erect, sometimes pendent; **Cal** green, glandular-hairy, tube 1 - 11 mm (sometimes longer than the lobes), lobes ovate, ovate-lanceolate or oblong-elliptic, acute, 2.5 - 13 × 1.5 - 4.5 mm; **Cl** glandular-hairy, salmon-pink, orange-yellow or yellow, greenish in the lower part; **Cl** tube cylindrical, inflated and 4-angled in the lower ½, 8 - 15 mm, lobes obovate or lanceolate, mucronate, 2 - 6.5 × 1 - 4 mm; **St** inserted above (or ± at) the middle of the **Cl** tube, included; **Anth** oblong, 0.5 - 1 mm; **NSc** linear, acute, 2.5 - 4.5 × 0.2 - 0.3 mm; **Ca** fusiform, 5 - 9 mm; **Sty** 0.5 - 1.5 mm; **Se** clavate, 0.5 - 0.7 mm.

This is one of the most common species and has

the largest geographical range, practically embracing the distributional range of the whole genus. This in part explains the extensive synonymy, which moreover is indicative of the pronounced variability observable.

It is interesting to note that *K. lanceolata* shows characteristics of both sections of the genus: The flowers can be erect (as in Sect. *Kalanchoe*) or pendent (as in Sect. *Bryophyllum*). Other characters pointing to *Bryophyllum* are the inflorescences which are coiled back before anthesis, as well as the calyx with its long and enlarged tube.

Raadts (1977) describes the hybrid *K. densiflora* × *K. lanceolata* from Kenya.

K. lateritia Engler (Pfl.-welt Ost-Afr., Teil C, 189, 1895). **T** [lecto]: Tanzania, Tanga Distr. (*Holst* 2986 [B, K, P]). - **D:** C and E Africa; (semi-) deciduous to evergreen wood- or bushland etc. on sandy or rocky ground, to 2000 m; naturalized in Australia (Queensland). **I:** Hamet & Marnier-Lapostolle (1964: t. 2: fig. I, K, figs. 89-91).

Incl. *Kalanchoe coccinea* var. *subsessilis* Britten (1871) ≡ *Kalanchoe integra* var. *subsessilis* (Britten) Cufodontis (1969); **incl.** *Kalanchoe cuisinii* De Wildeman & T. Durand (1900); **incl.** *Kalanchoe kirkii* N. E. Brown (1902); **incl.** *Kalanchoe zimbabwensis* Rendle (1932) ≡ *Kalanchoe lateritia* var. *zimbabwensis* (Rendle) Brenan (1954); **incl.** *Kalanchoe lateritia* var. *prostrata* Raadts (1977); **incl.** *Kalanchoe lateritia* var. *pseudolateritia* Raadts (1977) ≡ *Kalanchoe crenata* var. *pseudolateritia* (Raadts) Raadts (1985).

[1] Perennials, pubescent-glandular, 0.2 - 1.5 m tall, **Ha** of the indumentum to 1 - 1.5 mm; stems usually simple, erect, decumbent or prostrate; **L** subsessile to petiolate, fleshy, petiole 0.5 - 5 cm, flattened and grooved above, lamina ovate-oblong, obovate or subcircular, spatulate to linear, glabrous or glandular-pubescent, 3.5 - 21 × 3 - 12.5 cm, tip rounded to obtuse, base rounded to cuneate, rarely truncate, margins doubly crenate, crenate or subentire; **Inf** corymbiform cymes, very densely rusty pubescent-glandular, 5 - 30 cm tall; **Ped** 1 - 5 mm; **Fl** erect; **Cal** green, lineolate with red, tube 0.3 - 1.5 mm, lobes oblong-ovate to oblong-lanceolate, ± acute, 3.5 - 9 × 1 - 3 mm; **Cl** red, reddish-orange, salmon-pink or pale yellow, yellowish-green to white in the lower part, **Cl** tube cylindrical, inflated in the lower ½, 8.5 - 14 mm, lobes ovate or elliptic, attenuate or abruptly long apiculate, 4.5 - 8.5 × 2 - 6 mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** ovate, 0.7 - 1 mm; **NSc** linear, obtuse, 1.2 - 4 × 0.2 - 0.4 mm; **Ca** linear-lanceolate, 4.5 - 10 mm; **Sty** 1 - 2.5 mm; **Se** oblong-linear, ± 1 mm.

This species was originally considered as a variety of *K. crenata*. It is in fact very similar to some forms of *K. crenata* but may be distinguished by quantitative variations of several features.

The 2 varieties described by Raadts (1977) are of

doubtful status (Wickens 1987) and are here tentatively synonymized.

K. latispala N. E. Brown (BMI 1908: 435, 1908). **T:** Malawi (*Anonymus* s.n. [K]). – **D:** Malawi, Moçambique; desert rocks. **I:** Hamet & Marnier-Lapostolle (1969: pl. 2-3); Eggli (1994: 219).

[1] Perennials, 0.25 - 1 m tall, with $\pm$ dense indumentum of glandular **Ha**; stems usually simple, erect, woody and 1 - 1.5 cm $\varnothing$ at the base with smooth and papery bark, terete to subquadrangular above, green, yellow-green to purple-brown; **L** usually sessile, fleshy, carinate, green to yellow-green, bordered with red, lamina ovate, obovate, oblong to oblong-spatulate, glabrous (lower **L**) or glandular-pilose, 4.5 - 12.5 $\times$ 3.5 - 9 cm, tip obtuse to rounded, base cuneate, attenuate subamplexicaul, margins irregularly crenate or dentate; **Inf** corymbiform, usually dense, 9 - 18 cm wide, pilose; **Ped** 5 - 10 mm; **Fl** erect; **Cal** green, glandular-hairy on both faces, tube 2.5 - 5 mm, lobes oblong to ovate, acute, fleshy, 7 - 13 $\times$ 4 - 6 mm; **Cl** white or greenish-white, glandular-pubescent, tube suburceolate to 4-angled below, 4-angled-tubular above, 30 - 35 mm, lobes ovate or elliptic-ovate, acute and apiculate, spreading or reflexed, 12 - 15 $\times$ 6.5 - 9 mm; **St** inserted above the middle of the **Cl** tube, upper **St** exserted; **Anth** ovate, 1 - 2 mm; **NSc** linear, 3.5 - 7 mm; **Ca** 12 - 15 mm; **Sty** 17.5 - 20 mm.

K. laxiflora Baker (JLSB 22: 472-473, 1887). **T:** Madagascar (*Baron* 4306 [K]). – **D:** C Madagascar; rocks. **I:** Hamet & Marnier-Lapostolle (1964: figs. 47-49); Boiteau & Allorge-Boiteau (1995: 109); Rauh (1995a: figs. 396-397).

$\equiv$ *Kitchingia laxiflora* (Baker) Allorge-Boiteau (1995) (*nom. inval.*, Art. 34.1c); **incl.** *Bryophyllum crenatum* Baker (1883) $\equiv$ *Kalanchoe crenata* (Baker) Hamet (1907) (*nom. illeg.*, Art. 53.1); **incl.** *Kalanchoe tieghemii* Hamet (1914); **incl.** *Kalanchoe laxiflora* ssp. *stipitata* Boiteau & Mannoni (1949); **incl.** *Kalanchoe laxiflora* ssp. *subpeltata* Boiteau & Mannoni (1949); **incl.** *Kalanchoe laxiflora* ssp. *violacea* Boiteau & Mannoni (1949).

[2] Perennials, entirely glabrous, to 50 cm tall; stems erect, branching from the base, flowering stems initially prostrate at the base and rooting, then ascending; **L** petiolate, green to bluish-green, generally edged with red, sometimes with brown or red spots, petiole slender, 1.5 - 6 cm, lamina $\pm$ ovate, 2 - 6 $\times$ 1.5 - 3.5 cm, tip obtuse, base $\pm$ distinctly auriculate (auricles varying from very reduced to large), margins conspicuously crenate, sinuses sometimes with red spots, with bulbils on the teeth; **Inf** dense corymbiform cymes; peduncle to 50 cm; **Ped** very slender, 8 - 16 mm; **Fl** pendent; **Cal** yellow-green, orange-red to violet, tube 5 - 12 mm, lobes $\pm$ deltoid, acute, 3 - 7 mm; **Cl** red, red-purple, rose, rose-orange, orange-red, orange-yellow to pale yellow, **Cl** tube cylindrical, 10 - 20 mm, lobes

obovate, obtuse, 3 - 5 $\times$ 2.5 - 3 mm; **St** inserted just below the middle of the **Cl** tube, upper **St** included or slightly exserted; **Anth** reniform, $\pm$ 1 mm; **NSc** rounded, $\pm$ 0.4 $\times$ 0.6 mm; **Ca** 5.5 - 10 mm; **Sty** 7 - 11 mm.

Similar to *K. fedtschenkoi* esp. in habit. The taxon is very variable in the size of calyx and corolla, as well as in the colour of flowers and leaves. The subspecies described by Boiteau & Mannoni (1949) are tentatively synonymized here.

K. leblanciae Hamet (RSN 11: 294, 1912). **T:** Moçambique (*Junod* 443 [G]). – **D:** Moçambique, RSA; open forests and shrubby savannas near the coast, on sandy soils, to 200 m.

[1] Perennials or biennials, completely glabrous, 0.3 - 1.6 m tall; stems simple, erect, woody at the base, $\pm$ distinctly 4-angled, with tenuous whitish bloom; **L** sessile, flat, fleshy, oblong to oblong-spatulate, to 10 $\times$ 1 - 3 cm, tip rounded or obtuse, base attenuate, not amplexicaul, margins crenate, sinuate to serrate-lobed; **Inf** dense many-flowered corymbose cymes or panicles, reddish-brown, 3 - 15 cm; **Ped** slender, 3 - 4.5 mm; **Fl** erect; **Cal** tube 4-angled, contracted towards the base, 0.6 - 0.9 mm, lobes oblong, lanceolate to triangular, acute, 1 - 2 $\times$ 1 - 1.2 mm; **Cl** yellow-green, yellow, salmon to bright red, tube 4-angled, constricted towards the base, 7 - 8 mm, lobes suboblong to ovate, tip rounded or obtuse, 2 - 3 $\times$ 1.7 - 2 mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** oblong, 0.5 - 0.8 mm; **NSc** linear-lanceolate, acute, $\pm$ 1.5 $\times$ 0.4 mm; **Ca** ovate-oblong, attenuate, 5.5 - 6 mm; **Sty** 0.7 - 1.2 mm.

K. lindmanii Hamet (Ark. Bot. 13: 1-5, t. 1, fig. 1, 1913). **T:** Angola, Huila (*Fritzsche* 142 [S]). – **D:** Angola (Huila); xerophytic woods, on stony soils, 1800 - 2000 m. **I:** Hamet (1931-1963: 3: tt. 45-46, 1958).

Incl. *Kalanchoe pearsonii* N. E. Brown (1914); **incl.** *Kalanchoe humbertii* Guillaumin (1939); **incl.** *Kalanchoe gossweileri* Croizat (1942).

[1] Perennials, entirely glabrous, to 60 cm tall; **R** tuberous; stems simple, erect, robust, thick, sometimes inflated at the base to 2 cm $\varnothing$; **L** sessile, tough, ovate, oblong to oblong-linear, 2.5 - 12 (-18) $\times$ 1 - 4 cm, tip obtuse to acute, constricted and then $\pm$ enlarged towards the base, margins entire to slightly sinuate; **Inf** dense corymbs, 4.5 - 20 cm long and wide; **Ped** slender, 8 - 16 mm; **Fl** erect; **Cal** campanulate, shorter, equal or often longer than the **Cl**, **Cal** tube 1.2 - 1.6 mm, lobes linear, ovate-linear, subacute, subcuspidate, 6 - 17 $\times$ 2.4 - 3.4 mm; **Cl** suburceolate, yellow, tube 9 - 13 mm, lobes ovate, ovate-oblong, acutely cuspidate, 4 - 7 $\times$ 2.5 - 3.5 mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** ovate, obtuse, $\pm$ 1.25 mm, with a little globule at the tip; **NSc** sublinear, emarginate, 4 - 6 $\times$ 0.6 - 1 mm; **Ca** oblong, attenuate towards

the tip, 10 - 13 mm; **Sty** very short, 0.4 - 0.6 mm; **Se** oblong-obovate, 1.1 - 1.3 mm.

This species has 2 interesting characters: The calyx is as long as or longer than the corolla (a character which is also present in some species of Sect. *Bryophyllum*), and the styles are almost completely reduced.

K. linearifolia Drake (Bull. Mus. Hist. Nat. (Paris) 9: 41, 1903). **T**: Madagascar (*Grandidier* s.n. [P]). – **D**: S Madagascar; xerophytic bush on limestone, fairly common. **I**: Hamet & Marnier-Lapostolle (1964: figs. 76-79); Boiteau & Allorge-Boiteau (1995: pl. 5: 11, 147). **Fig. XIX.c**

Incl. *Kalanchoe bonnierii* Hamet & H. Perrier (1907).

[1] Perennial shrublets, much-branched, entirely glabrous, 1 - 1.5 m tall; stems woody, terete, somewhat climbing; **L** grey, sessile, lamina subcylindrical, furrowed on the upper face, 3 - 13 × 0.4 - 1 cm, tip acute, base truncate, not amplexicaul; **Inf** lax corymbs, 4 - 13 cm; **Ped** 6 - 8 mm; **Fl** erect to spreading; **Cal** green, red-tinged, very fleshy, tube 2 - 3 mm, lobes deltoid, acute, 3 - 4 × ± 4.5 mm; **Cl** urceolate, very fleshy, brilliant red, tube 4-angled, 7 - 11 mm, lobes ovate, acute, cuspidate with a conspicuous keel, curved outwards, 3 - 4.5 × 2.5 - 4 mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** ovate-oblong, 2 - 2.5 mm; **NSc** ± rectangular, obtusely emarginate, ± 0.6 × 1.5 - 2 mm; **Ca** 6 - 7 mm; **Sty** 2 - 3 mm; **Se** obovate, ± 2.5 mm.

K. lobata R. Fernandes (Bol. Soc. Brot., sér. 2, 52: 200-201, 1978). **T**: Zimbabwe (*Plowes* 2176 [K]). – **D**: Zimbabwe; on schistose rocks, 1300 m.

[1] Perennials (?), to 65 cm tall; stems erect, terete, rigid, densely glandular-hairy; **L** petiolate, flat, fleshy, petiole narrow, broadened at the base, lamina irregularly incised-lobed to 3-lobed (basal **L** simple), base cuneate, sparsely hairy, pale green to yellowish; **Inf** corymbiform panicles to 6 cm; **Ped** 2.5 - 5.5 mm; **Fl** erect; **Cal** pale green, rounded at the base, densely and shortly glandular-hairy, tube 2.5 - 3.5 mm, lobes ovate-lanceolate, acute, 3.5 - 4 × 2.5 - 3.5 mm; **Cl** orange or yellow, tube cylindrical, dilated at the base, very contracted just above the **Ca**, 15 - 16 mm, lobes apiculate, 5 - 5.5 × 2.5 - 3 mm; **St** included; **Anth** ± 0.7 mm; **Ca** ± 7.5 mm; **Sty** ± 0.5 mm.

This species approaches *K. laciniata* and is very similar to *K. lanceolata*.

K. longiflora Schlechter ex J. M. Wood (Natal Pl. 4: t. 320, 1903). **T**: RSA, KwaZulu-Natal (*Wood* 4439 [NH]). – **D**: RSA (KwaZulu-Natal); on rocks. **I**: Hamet & Marnier-Lapostolle (1964: figs. 92-93).

Incl. *Kalanchoe longiflora* var. *genuina* Hamet (1972) (*nom. inval.*, Art. 24.3).

[1] Lax succulent perennials, entirely glabrous, to 40 cm tall; stems robust, 4-angled, erect with de-

cumbent **Br**; **L** sessile to shortly petiolate, petiole 1 - 15 mm, clasping, lamina ovate-oblong, obovate to almost orbicular, grey-green with thick bloom or green with red-purple margins to completely red-violet, 4 - 8 × 3 - 8 cm, tip obtuse to rounded, base cuneate, margins entire in lower part, above crenate or with few rounded patelliform teeth; **Inf** many-flowered corymbs; **Ped** 1 - 2 cm; **Fl** erect; **Cal** green tinged with red-violet, tube ± 1 mm, lobes narrowly triangular, acute, 2 - 3 mm; **Cl** green, yellowish-green, yellow to orange, tube elongate-ampullaceous to almost cylindrical-quadrangular, 11 - 17 mm, lobes ovate to lanceolate, obtuse, 2 - 4.5 × 2 - 3 mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** ovate-orbicular, 0.7 - 1.2 mm; **NSc** linear, obtuse, 3 - 4 × ± 0.4 mm; **Ca** ovate-lanceolate, 12 - 13 mm; **Sty** ± 6 mm; **Se** ± 0.8 mm.

This endemic species is related to *K. sexangularis*.

K. longifolia Geddes (BMI 1929: 112-113, 1929). **T**: Thailand (*Kerr* 8775 [not located]). – **D**: Thailand; limestone rocks, 300 m.

[1] Perennials, 20 - 60 cm tall; stems simple or branched, erect, to 1.5 cm Ø at the base, young green and finely pubescent, old reddish and glabrous; **L** petiolate, green, fleshy, simple or sometimes 3-partite, petiole 2.5 - 7 cm, grooved above, amplexicaul at the base, finely glandular-hairy, lamina glabrous above, below finely glandular-hairy becoming glabrous, 7.5 - 14 × 3.5 - 6 cm, lamina of simple **L** or lower leaflets ovate-lanceolate, upper leaflets lanceolate to linear-lanceolate, tip obtuse, base cuneate to rounded, margins thickened, denticulate to serrate; **Inf** shape not recorded, to 15 cm, covered with sparse long indumentum; **Ped** shortly glandular-hairy, ± 5 mm; **Fl** erect, sparsely covered with short glandular **Ha**; **Cal** green, divided nearly to the base, lobes linear-lanceolate, subacute, ± 8 × 2 mm; **Cl** tube cylindrical, upper parts 4-angled, green to pale green, ± 13 mm, lobes yellow, oblong-oblancheolate, acuminate, ± 8 × 4 mm; **St** inserted above the middle of the **Cl** tube, slightly exerted; **Anth** green; **NSc** subulate, ± 4 mm; **Ca** incl. **Sty** ± 9 mm.

Close to *K. craibii*.

K. lubangensis R. Fernandes (Bol. Soc. Brot., sér. 2, 53: 400-401, 1980). **T**: Angola, Huila (*Henriques* 433 [LUI]). – **D**: Angola (Huila).

[1] Perennials, entirely glabrous, to 80 cm tall; stem simple, erect, terete, to 12 mm Ø towards the base; **L** petiolate, fleshy, petiole to 3.5 cm, grooved above, enlarged to the base and amplexicaul, lamina ovate-lanceolate, lanceolate to elliptic, to 11.5 × 4 cm, sometimes basally 2- to 3-partite with oblong segments, tip attenuate, ± acute, base attenuate to ± rounded, margins dentate-serrate with acute teeth or irregularly crenate or entire; **Inf** corymbose to pani-

culat, 13 - 27 cm long and wide; **Ped** slender, 5 - 13 mm; **Fl** erect; **Cal** tube 0.25 - 0.5 mm, lobes deltoid, acute, 2 - 4 × 1.2 - 1.7 mm; **Cl** yellow, tube enlarged, rounded at the base, 4-angled above, 13 - 18 mm, lobes ovate, acute, ± cuspidate, 2.5 - 4 × 1.5 - 2.5 mm; upper **St** slightly exerted; **Anth** oblong, ± 0.7 mm; **NSc** linear, ± emarginate, 3.5 - 5 mm; **Ca** 11 - 12 mm; **Sty** 3.5 - 4 mm.

Insufficiently known species close to *K. brachyloba*.

K. luciae Hamet (Bull. Herb. Boissier, sér. 2, 8: 254-256, 1908). **T:** RSA, Transvaal (*Junod* s.n. [GJ]). – **D:** Zimbabwe, Moçambique, RSA, Swaziland. **I:** Hamet (1931-1963: tt. 78-80, 1960); Hamet & Marnier-Lapostolle (1964: figs. 112-114).

[1] Biennal shrublets, 0.5 - 2.5 m tall, glabrous with white mealy layer or hairy; stems simple or branched, erect, straight, terete to 4-angled; **L** sessile, flat, glabrous or hairy, oblong, obovate, spatulate or orbicular, 4 - 23 × 2 - 15 cm, tip rounded or obtuse, base rounded or truncate, semi-amplexicaul, margins entire, grey-green to yellowish-green with margins tinged red; **Inf** many-flowered dense thyrses or panicles, 32 - 40 cm; **Ped** to 1 cm; **Fl** erect; **Cal** tube 0.7 - 1.5 mm, lobes lanceolate to oblong, acute, 3 - 7 × 2.2 - 4 mm; **Cl** pale yellowish-green, sometimes mealy, tube 4-angled-urceolate, 6 - 12 mm, lobes oblong, ovate-triangular, obtuse, 4 - 7 × 2.5 - 3 mm, tips reflexed; **St** inserted near the upper ¼ of the **Cl** tube, exerted; **Anth** 0.8 - 1 mm; **NSc** oblong to square, tip cuneate, entire, emarginate or 3-lobate, 1 - 2 × 2 - 2.5 mm; **Ca** 7 - 11.5 mm; **Sty** 2.7 - 3.5 mm; **Se** 1.3 - 1.5 mm.

K. luciae ssp. **luciae** – **D:** Zimbabwe, Moçambique, RSA; on hills and ridges, granite slopes in woodlands or savanna. **I:** Tölken (1985: 70: fig. 2).

Incl. *Kalanchoe aleurodes* Stearn (1931); **incl.** *Kalanchoe albiflora* H. M. L. Forbes (1941).

[1] Plants often to 1.5 m tall, usually glabrous; **L** obovate to orbicular, rarely oblanceolate; **Cal** lobes 2.5 - 5 mm, glabrous; **NSc** usually square to transversally oblong.

K. luciae ssp. **montana** (Compton) Tölken (JSAB 44(1): 89, 1978). **T:** Swaziland (*Compton* 29471 [NBG]). – **D:** RSA, Swaziland. **I:** Tölken (1985: 70: fig. 3).

≡ *Kalanchoe montana* Compton (1967).

[1] Plants rarely > 1 m tall, usually hairy; **L** narrowly oblanceolate to rarely obovate; **Cal** lobes 5 - 7 mm, with scattered **Ha**; **NSc** oblong.

K. macrochlamys H. Perrier (Arch. Bot. Bull. Mens. 2(2): 27-28, 1928). **T:** Madagascar (*Perrier* 6561 [P]). – **D:** NW Madagascar (Sambirano); moist rocky places. **I:** Boiteau & Allorge-Boiteau (1995: pl. 4: 3).

≡ *Bryophyllum macrochlamys* (H. Perrier) A. Berger (1930).

[2] Bi- to triennials, ± succulent, entirely glabrous, 0.8 - 1.2 m tall; **R** tuberous; **L** sessile, large, very variable in shape through the year, median vein as a deep groove; dry season **L** thick, generally entire, narrow, 30 - 40 × 2 - 4 cm, margins irregularly crenate; wet season **L** thin, 3- to 5-pinnatisect, to 40 × 10 cm, base auriculate, amplexicaul, segments oblong, 15 - 20 × 5 - 10 cm, tip obtuse, margins entire to irregularly crenate-dentate; **Inf** large panicles; **Bra** filamentous, 20 - 24 mm; **Ped** 8 - 12 mm; **Fl** pendent; **Cal** very much inflated, white-yellowish with dark lines, rounded at the base, tube cylindrical, 30 - 40 mm, with 3 conspicuous veins, lobes ovate-deltoid, acutely mucronate, 8 - 12 × 4 - 5 mm; **Cl** ± included in or reaching the top of the **Cal**, tube globose at the base, constricted above, then ± oblong, glabrous or sparingly glandular-hairy, 30 - 40 mm, lobes ovate-deltoid, acutely acuminate, 5 - 7 × ± 6 mm; **St** inserted towards the base of the **Cl** tube, all included; **Anth** oblong, 3 - 4 mm; **NSc** suborbicular, ± 2.5 mm; **Ca** oblong, 7 - 8 mm; **Sty** 22 - 24 mm.

K. mandrarensis Humbert (Notul. Syst. (Paris) 8: 4-5, 1939). **T** [syn]: Madagascar (*Humbert* 12690 [P]). – **D:** SE Madagascar; xerophytic forest, on rocks, 600 - 900 m.

[2/1] Perennials, 20 - 30 cm tall, entirely covered with stellate russet **Ha**; stems woody at the base, to 3 mm Ø, decumbent and rooting, **Br** ascending, subfleshy; **L** petiolate, fleshy, thick, petiole terete, 7 - 25 mm, lamina ovate-suborbicular, 1.5 - 2 cm long and wide, tip rounded, base broadly rounded to attenuate-cuneate, margins sharply dentate with deltoid 2 - 3 mm long teeth; **Inf** few-flowered cymes; **Ped** ± 1 cm; **Fl** pendent; **Cal** broadly campanulate, tube ± 5 mm, lobes deltoid, acute, ± 3 × 4 mm; **Cl** somewhat fleshy, broadly campanulate, cream, tube almost 4-angled, 12 - 15 mm, lobes semi-orbicular, erect, 4 - 5 mm; **St** inserted a little above the middle of the **Cl** tube, all included; **Anth** ovate, ± 2 mm; **NSc** deltoid, thick, ± 0.5 mm; **Ca** oblong, ± 7 mm; **Sty** ± 7 mm.

This species is intermediate between Sect. *Kalanchoe* (stamens inserted above the middle of the corolla tube) and Sect. *Bryophyllum* (pendent flowers, calyx tube longer than calyx lobes, though no bulbils) but is closer to the latter. The illustration in Boiteau & Allorge-Boiteau (1995: 163) under this name shows *K. rosei*.

K. manginii Hamet & H. Perrier (Ann. Sci. Nat. Bot., sér. 2, 16: 370-373, 1912). **T:** Madagascar (*Perrier* 11790 [P]). – **D:** C Madagascar (Andringitra Massif); dry rocky slopes, to 2000 m. **I:** Boiteau & Allorge-Boiteau (1995: 75); Rauh (1995a: figs. 398-399). **Fig. XIX.d**

≡ *Bryophyllum manginii* (Hamet & H. Perrier)

Nothdurft (1962); **incl.** *Kalanchoe manginii* var. *triploidea* Mannoni & Boiteau (1948) $\equiv$ *Bryophyllum manginii* var. *triploideum* (Mannoni & Boiteau) Nothdurft (1962) (*nom. inval.*, Art. 33.2).

[2] Perennials, to 40 cm tall, creeping; stems numerous, forming a tuft, slender, woody, erect or decumbent, sterile stems pubescent-glandular, flowering stems glabrous; **L** subsessile, very fleshy, to 8 mm thick, glabrous to $\pm$ minutely pubescent, clear green, obovate, obovate-orbicular, obovate-spatulate, oblong to orbicular, 1 - 3 $\times$ 0.6 - 1.5 cm, tip very obtuse, base attenuate, not amplexicaul, margins entire, sometimes slightly crenate in upper part; **Inf** short-stalked lax few-flowered panicles with bulbils; **Ped** 7 - 10 mm, hairy; **Fl** pendent; **Cal** green to green-reddish, glandular-hairy, tube 0.4 - 0.8 mm, lobes ovate to oblong, acute, 6.5 - 9 $\times$ 2.4 - 3.5 mm; **Cl** urceolate-quadrangular, red-orange to bright red, tube 20 - 25 mm, lobes ovate, apiculate, 3.5 - 4.5 $\times$ 4.5 - 5 mm; **St** inserted towards the base of the **Cl** tube, upper **St** exserted; **Anth** reniform, $\pm$ 1.6 mm; **NSc** linear, emarginate, $\pm$ 1.8 mm; **Ca** 8 - 9 mm; **Sty** 14 - 17 mm; **Se** obovate-oblong, $\pm$ 0.9 mm.

A fine decorative species of very easy cultivation.

K. marmorata Baker (Gard. Chron., ser. 3, 12: 300, 1892). **T:** Eritrea (*Penzig* s.n. [K]). - **D:** C and E Africa; rocky slopes and cultivated lands, 1200 - 2400 m. **I:** Gilbert (1989: 21, fig. 88.8: 1-2). **Fig. XIX.e**

Incl. *Kalanchoe grandiflora* A. Richard (1847) (*nom. illeg.*, Art. 53.1); **incl.** *Kalanchoe macrantha* Baker (1892) $\equiv$ *Kalanchoe macrantha* var. *marmorata* (Baker) Maire (1977); **incl.** *Kalanchoe somaliensis* Baker (1895) $\equiv$ *Kalanchoe marmorata* fa. *somaliensis* (Baker) Pampanini (1909) $\equiv$ *Kalanchoe macrantha* var. *somaliensis* (Hooker) Maire (1977); **incl.** *Kalanchoe kelleriana* Schinz (1896); **incl.** *Kalanchoe grandiflora* var. *angustipetala* Engler (1902) (*nom. inval.*, Art. 43.1); **incl.** *Kalanchoe marmorata* var. *maculata* Terracciano ex Senni (1905); **incl.** *Kalanchoe rutshuruensis* Lebrun & Toussaint (1947) (*nom. inval.*, Art. 32.1c?); **incl.** *Kalanchoe macrantha* var. *richardiana* Maire (1977).

[1] Perennials, entirely glabrous, pruinose, 0.5 - 1.3 m tall; stem erect or decumbent at the base; **L** sessile, obovate to broadly obovate or subcircular, glaucous grey-green, often with purple markings above and beneath, 20 - 25 $\times$ $\pm$ 13 cm, tip obtuse to rounded, base cuneate to semi-amplexicaul, margins entire, undulate, crenate or serrate; **Inf** paniculate cymes to 30 cm; **Ped** 15 - 25 mm; **Fl** erect; **Cal** tube 1 - 2 mm, lobes linear-triangular, long-attenuate, 5 - 17 $\times$ 2 - 6 mm; **Cl** pure white, rarely cream, sometimes flushed very pale pink, lower parts greenish, tube 1.9 - 12 cm, lobes lanceolate to broadly obovate, mucronate, 6 - 25 $\times$ 6 - 13 mm; **St** inserted

above the middle of the **Cl** tube, upper **St** very shortly exserted; **Anth** oblong, 0.7 - 2.5 mm, with apical **Gl**; **NSc** linear, 4 - 12.5 mm; **Ca** ovate-lanceolate in lateral view, 9 - 30 mm; **Sty** 9 - 80 mm.

Very decorative plants due to the marbled leaves and esp. its large white or rosy flowers, without doubt the most beautiful *Kalanchoe* of Africa and often cultivated both as an ornamental and as a medicinal plant.

K. marnieriana H. Jacobsen (Handb. Sukk. Pfl. 2: 835, 1954). **T:** Madagascar (*Humbert* 4901 [TAN, P]). - **D:** SE Madagascar; moist rocky places. **I:** Hamet & Marnier-Lapostolle (1964: figs. 50-51); Boiteau & Allorge-Boiteau (1995: 101). **Fig. XIX.f** $\equiv$ *Bryophyllum marnierianum* (H. Jacobsen) Byalt (2000); **incl.** *Kalanchoe humbertii* Mannoni & Boiteau (1947) (*nom. illeg.*, Art. 53.1).

[2] Perennials, entirely glabrous, much-branched, forming tufts to 30 cm tall; stems creeping at the base and rooting, later ascending, red, spotted with brown in the lower parts, with 2 ribs between the nodes; **L** often crowded near **Br** tips, petiolate, glaucous, bluish, with violet spots, petiole cylindrical, 3 - 8 mm, lamina obovate to suborbicular, 3 - 4 $\times$ 2 - 3 cm, tip rounded, base subcordate, slightly auriculate, margins subentire, sometimes a few crenations in the upper part, with numerous bulbils on the teeth; **Inf** corymbiform; peduncle 9 - 12 cm; **Fl** pendent; **Ped** 1 - 1.5 cm; **Cal** green to green-purple, tube 9 - 11 mm, lobes deltoid, acute, 7 - 8.5 $\times$ $\pm$ 6 mm; **Cl** urceolate-tubular, yellow, orange to pink, tube $\pm$ 8-angled, 20 - 35 mm, lobes obovate, obtuse, 5 - 6 mm long and wide; **St** inserted below the middle of the **Cl** tube, upper **St** slightly exserted; **Anth** orbicular, $\pm$ 1.5 mm; **NSc** deltoid-oblong, emarginate, 0.7 - 1 $\times$ $\pm$ 1 mm; **Ca** rounded, $\pm$ 6 mm; **Sty** 15 - 18 mm.

The species is close to *K. fedtschenkoi* and *K. laxiflora* with which it forms a homogeneous group. All have the same habit, biology and ecology.

K. migiurtinorum Cufodontis (Webbia 19: 727-728, pl. 1: fig. 6-7, 1965). **T:** Somalia, North-East (*Merla & al.* s.n. [FI]). - **D:** N Somalia; gypsum or limestone hills in semidesert, 200 - 1850 m. **Fig. XXI.b**

[1] Perennials, to 60 cm tall, glabrous or glandular-papillose, glaucous; stems erect, terete; **L** sessile, very fleshy, tough, flat or $\pm$ sausage-shaped, oblong-lanceolate, obovate to broadly spatulate, 3 - 10 $\times$ 1 - 4.2 cm, tip subacute, base attenuate, margins entire; **Inf** dense cymes, 10 - 15 cm; **Ped** 5 - 10 mm; **Fl** erect; **Cal** early deciduous, glabrous or glandular-papillose, tube $\pm$ 0.2 mm, lobes lanceolate, acute, 1.5 - 6 $\times$ $\pm$ 1 mm; **Cl** white to yellowish, sometimes flushed with pink, tube cylindrical, broadened at the base, 25 - 32 mm, lobes lanceolate, acute, glabrous or glandular-papillose, sometimes finely marked with purplish dots or lines, 6 - 8 $\times$ 2.5

- 3 mm; **St** inserted above the middle of the **Cl** tube, included or upper **St** partly exserted; **Nsc** linear, 4.5 - 5.5 mm; **Ca** 16 - 18 mm; **Sty** 5 - 7 mm; **Se** $\pm$ 0.5 mm.

A very variable species, esp. in leaf shape, with 2 local forms: plants with narrowly sausage-shaped leaves on gypsum and plants with flat leaves on limestone.

K. millotii Hamet & H. Perrier (Ann. Sci. Nat. Bot., sér. 9, 16: 374-376, 1912). **T:** Madagascar (Perrier 11789 [P]). - **D:** C-S and S Madagascar; dry forests and xerophytic bush. **I:** Hamet & Marnier-Lapostolle (1964: figs. 26-28); Boiteau & Allorge-Boiteau (1995: 159).

[1] Perennial shrublets, much-branched, forming dense tufts 0.4 - 1 m tall, entirely covered with dense minute whitish stellate **Ha**; stems woody, stout, erect; **L** petiolate, flat, fleshy, thick, clear green to greyish-green, petiole fleshy, grooved above, slightly enlarged at the base, 5 - 18 mm, lamina obovate, ovate to orbicular, 3 - 6.5 cm long and wide, tip rounded and ending with an acute tooth, base cuneate, margins irregularly sinuate-dentate with broad acute teeth; **Inf** $\pm$ dense corymbose panicles, 2 - 10 cm; **Ped** thick, 3 - 4 mm; **Fl** erect; **Cal** yellow-green to orange, glandular-hairy, tube 4 - 5 mm, lobes deltoid, acute, 3.5 - 4.5 $\times$ 3.2 - 3.5 mm; **Cl** tubular, yellow-green to yellow-orange, tube cylindrical, 9 - 11 mm, lobes linear-rectangular, ovate to rounded, acute, 3 - 4 $\times$ 2 - 2.5 mm; **St** inserted above the middle of the **Cl** tube, all exserted; **Anth** yellow, reniform, $\pm$ 0.7 mm; **Nsc** trapeziform, emarginate, $\pm$ 1 mm; **Ca** oblong, 7 - 9 mm; **Sty** 2.5 - 3.5 mm; **Se** obovate, $\pm$ 0.8 mm.

A robust and easily cultivated species with quite attractive foliage.

K. miniata Hilsenberg & Bojer ex Tulasne (Ann. Sci. Nat. Bot., sér. 4, 8: 149, 1857). **T:** Madagascar (Bojer s.n. [P]). - **D:** C Madagascar; also cultivated and sometimes escaping from gardens in tropical Africa. **I:** Boiteau & Allorge-Boiteau (1995: 67); Rauh (1995a: figs. 400-402). **Fig. XX.a, XXI.a**

$\equiv$ *Kitchingia miniata* (Hilsenberg & Bojer ex Tulasne) Baker (1882) $\equiv$ *Bryophyllum miniatum* (Hilsenberg & Bojer ex Tulasne) A. Berger (1930); **incl.** *Kalanchoe subpeltata* Baker (1887) $\equiv$ *Kalanchoe miniata* [?] *subpeltata* (Baker) H. Perrier (1924); **incl.** *Kalanchoe miniata* [?] *andringitrensis* H. Perrier (1924) $\equiv$ *Bryophyllum miniatum* var. *andringitrense* (H. Perrier) Hort. ZSS (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Kalanchoe miniata* [?] *confertifolia* H. Perrier (1924); **incl.** *Kalanchoe miniata* [?] *subsessilis* H. Perrier (1924); **incl.** *Kalanchoe miniata* [?] *typica* H. Perrier (1924) (*nom. inval.*, Art. 24.3); **incl.** *Kalanchoe miniata* var. *sicaformis* Boiteau & Mannoni (1948).

[2] Perennials, completely glabrous, 30 - 80 cm

tall, erect, $\pm$ decumbent basally; stems simple, slender, terete, rooting at the base; **L** petiolate to sessile, fleshy, very variable in shape, sometimes $\pm$ peltate, petiole (when present) cylindrical, 1 - 4 cm, strongly broadened at the base and amplexicaul, sometimes with 2 unequal wings, lamina ovate, ovate-roundish, oblong, oblong-spatulate, sometimes tripartite, 2.5 - 9 $\times$ 1.2 - 6 cm, tip obtuse, rounded to emarginate, base rounded to subcordate, auriculate and amplexicaul (when petiole absent), margins crenate, dentate or undulate, sometimes with red spots; **Inf** very lax few- to many-flowered corymbose or paniculate cymes, 7 - 20 cm, abortive **Fl** sometimes replaced by bulbils; **Ped** 7 - 20 mm; **Fl** pendent; **Cal** green-yellowish, campanulate, tube 4.5 - 7 mm, lobes deltoid to semiorbicular, cuspidate, 4 - 8 $\times$ 5 - 8 mm; **Cl** tubular-campanulate, bright red, tube 22 - 35 mm, lobes deltoid to semicircular, cuspidate, 4 - 6 $\times$ 5 - 7 mm, sometimes yellow or orange; **St** inserted towards the base of the **Cl** tube, included or slightly exserted; **Anth** globose, $\pm$ 1.6 mm; **Nsc** subquadrate, emarginate, 0.9 - 1.4 mm; **Ca** ovate-oblong, 8 - 11 mm; **Sty** 20 - 25 mm; **Se** obovate, $\pm$ 0.8 mm.

This species has exceedingly variable leaves (size, shape, colour, presence or absence of petiole), and numerous varieties and "races" (here treated as having no rank under the Code and indicated with [?]) have been described, here all subsumed as synonyms. Some taxa described as varieties of *K. miniata* are now placed in the synonymy of *K. pubescens* or *K. pseudocampanulata* (see there).

K. mitejea Leblanc & Hamet (Notizbl. Königl. Bot. Gart. Berlin 5: 305, 1913). **T:** Kenya, Machakos Distr. (Scheffler 177 [B, P]). - **D:** N Uganda, Kenya, N Tanzania; wooded grassland, bushland and scrub, on sandy or humose soil, sometimes on rocky slopes, 250 - 2100 m. **I:** Hamet & Marnier-Lapostolle (1964: figs. 96-97).

[1] Perennials (?), entirely glabrous, pruinose; stems robust, erect, 0.5 - 3 m tall; **L** petiolate, petiole slender, terete, to 5 cm, lamina subovate to cordate, usually concave and boat-shaped with the basal part held at right angle to the main part of the lamina, glaucous above, pale green and usually with purple or maroon mottling beneath, 15 - 16 $\times$ 5 - 6 cm, tip acute to acuminate, middle **L** usually with 2 small lobes or auricles at the base, margins entire to slightly crenulate; **Inf** lax, many-flowered, cymose, 20 - 30 cm; **Ped** slender, 4 - 15 mm; **Fl** erect; **Cal** tube 0.5 - 1.3 mm, lobes deltoid to lanceolate-subulate, acute, 2 - 3.2 $\times$ 1.5 - 2 mm; **Cl** hypocrateriform, enlarged towards the base, tube 17 - 22 mm, lobes lanceolate-ovate to obovate, obtuse, apiculate, 4.5 - 6.5 $\times$ 2.5 - 4 mm; upper **St** inserted near the mouth of the **Cl** tube, lower **St** inserted above the middle of **Cl** tube, all **St** included or almost so; **Anth** oblong, 1.1 - 1.3 mm, with apical **Gl**; **Nsc** linear, emarginate to 3-fid, 2 - 4 mm; **Ca** ovoid to

linear-subulate, 10 - 14 mm; **Sty** 6 - 8 mm; **Se** oblong, ± 1 mm.

K. ndotoensis L. E. Newton (CSJA 70(2): 85-87, ills., 1998). **T:** Kenya, Eastern Prov. (*Powys & al.* 539 [K, EA]). – **D:** Kenya (Samburu Distr: Ndoto Mts.); montane forest, 1220 m.

[1] Perennial succulent epiphytes; stems branching, to 20 cm, to 4 mm $\varnothing$, pendulous, glabrous; **L** sessile, fleshy, glabrous, obovate, $\pm 8 \times 4$ cm, ± 4 mm thick, base $\pm$ rounded, tip cuneate to rounded, margins entire in the lower $\frac{1}{2}$, crenate above; **Inf** cymose, to 12-flowered, to 23 cm long, peduncle 2.5 cm long, almost glabrous at the base, above with few white **Ha**; **Ped** 2 - 3 mm; **Fl** erect; **Cal** tube ± 0.2 mm, lobes triangular, $\pm 7 \times 1.5$ mm, green, pubescent; **Cl** tube $\pm 13 \times 2 - 3$ mm, pubescent, lobes spreading, obovate, $\pm 7 \times 5$ mm, yellow, cuspidate; **St** inserted at or just below the middle of the **Cl** tube, included; **Anth** ± 0.7 mm; **NSc** linear or slightly tapering, ± 2 mm; **Ca** ± 6.5 mm; **Sty** ± 3 mm.

One of the rare epiphytic taxa of the genus. It is related to *K. citrina*. The position of the stamens in the corolla tube approaches the conditions normally found in Sect. *Bryophyllum*.

K. neglecta Tölken (JSAB 44(1): 90, 1978). **T:** RSA, KwaZulu-Natal (*Vahrmeijer & Tölken* 835 [PRE, K]). – **D:** RSA (NE KwaZulu-Natal); coastal plains on sandy soils.

[1] Perennials, entirely glabrous, to 1 m tall; stem single, terete; **L** petiolate, petiole 2 - 8 cm, slightly grooved above, not amplexicaul, lamina ovate, deeply cordate or peltate, flat to patelliform, green, $3.5 - 13 \times 3 - 9$ cm, base truncate or emarginate and bilobate, margins entire or slightly sinuate; **Inf** flat-topped many-flowered corymbose thyrses; **Cal** green, lobes narrowly lanceolate-triangular, 1.5 - 3 mm; **Cl** yellow to orange, tube almost cylindrical, 6 - 8 mm, lobes narrowly lanceolate, sharply pointed, $2.5 - 3.5 \times 1.5 - 2.5$ mm; **Anth** 0.6 - 0.8 mm; **NSc** linear, gradually tapering towards tip, 1.6 - 2.5 mm; **Se** ± 1 mm.

K. nyikae Engler (Pfl.-welt Ost-Afr., Teil C, 189, 1895). **T:** Tanzania, Lushoto Distr. (*Holst* 3918 [B $\dagger$?, P]). – **D:** Kenya, Tanzania. **I:** Hamet (1931-1963: tt. 60-64, 1958); Hamet & Marnier-Lapostolle (1964: figs. 102-103).

[1] Perennials, entirely glabrous, pruinose, 0.6 - 2 m tall; stems erect or decumbent at the base; **L** petiolate, flat, peltate or auriculate, $7 - 8 \times 6 - 7$ cm, petiole of middle **L** 3 - 10 cm, $\pm$ terete, slightly broadened towards the base, lamina of basal **L** suborbicular, cuneate or slightly cordate at the base, margins entire; lamina of upper **L** lanceolate; **Inf** paniculate cymes to 35 cm; **Ped** 6 - 13 mm; **Fl** erect; **Cal** green, tube 1 - 2 mm, lobes ovate to lanceolate, acute, $9 - 16 \times 3 - 5$ mm; **Cl** tube greenish,

subcylindrical, slightly broadened in the lower $\frac{1}{2}$, 17 - 21 mm, lobes ovate-lanceolate, acute, mucronate, cream outside, cream, yellow, pink or salmon-pink inside, $8 - 11 \times 3 - 5.5$ mm; **St** inserted in the upper part of the **Cl** tube, included or upper **St** slightly exerted; **Anth** oblong, with apical **Gl**, 1.2 - 2 mm; **NSc** linear-lanceolate in sideview, obtuse, 2.5 - 5 mm; **Ca** linear-lanceolate, 10 - 12 mm; **Sty** 6 - 9 mm; **Se** oblong, ± 0.6 mm.

K. nyikae ssp. *auriculata* Raadts (Willdenowia 8: 113-114, 1977). **T:** Tanzania, Musoma Distr. (*Greenway* 10760 [K, EA, PRE]). – **D:** SE Kenya, N Tanzania; dense or open bushland, usually on rocky ground or stony slopes, 700 - 1800 m.

[1] **L** lamina auriculate or cordate, to 15×12 cm, tip obtuse, base sometimes lobed, margins crenate, glaucous, usually mottled mauve-brown beneath; petiole 3 - 10 cm.

K. nyikae ssp. *nyikae* – **D:** SE Kenya, NE Tanzania; coastal and deciduous bushland, to 1000 m. **Fig. XX.b**

Incl. *Kalanchoe hemsleyana* Cufodontis (1967).

[1] **L** peltate, lamina ovate to suborbicular, to 18×16 cm; margins entire or subentire, brownish-green or glaucous above, paler beneath; petiole 3 - 6 cm.

K. obtusa Engler (Pfl.-welt Ost-Afr., Teil C, 189, 1895). **T:** Tanzania, Tanga Distr. (*Holst* 3161 [B, COI, K, M, P]). – **D:** SE Kenya, NE Tanzania; evergreen to semideciduous forests, generally on limestone, to 450 m. **I:** Hamet & Marnier-Lapostolle (1964: pl. 1: E).

[1] Small perennials, 10 - 15 cm tall; stems erect to decumbent, glabrous; **L** petiolate, glabrous, in 3 - 5 pairs, petiole flat, semi-amplexicaul, 0.5 - 2 cm, lamina ovate, obovate or suborbicular, green to reddish, $2 - 7 \times 1 - 5$ cm, tip obtuse, base cuneate to sometimes rounded, margins entire, sinuate or remotely crenate; **Inf** $\pm$ dense, corymbose, 2 - 7 cm; **Ped** 1 - 3 mm; **Fl** erect, pilose with a few glandular **Ha** or glabrous; **Cal** tube ± 0.4 mm, lobes lanceolate to linear-lanceolate, acute, $3.5 - 5.5 \times 1 - 1.8$ mm; **Cl** bright red, lower parts light green, tube cylindrical, 7 - 9.5 mm, lobes narrowly to broadly oblong-ovate, subobtusate, mucronate, $4.5 - 5.5 \times 2 - 3$ mm; **St** inserted near the middle of the **Cl** tube, included; **Anth** oblong to suborbicular, 0.6 - 0.7 mm, with apical **Gl**; **NSc** linear, emarginate, $1.5 - 2.5 \times \pm 0.3$ mm; **Ca** linear-lanceolate in sideview, 6.5 - 7 mm; **Sty** 1.5 - 2.5 mm; **Se** obovate.

K. olivacea Dalzell (in Dalzell & Gibson, Bombay Fl., 313, 1861). **T:** India (*Anonymus* s.n. [not located]). – **D:** India (Deccan, W Ghats); among rocks, rocky ground, moist shady places, 1200 - 1400 m.

[1] Perennials (?), glabrous, coloured entirely olive-brown, 20 - 100 cm tall; stems erect, terete,

thick, fleshy; **L** subsessile, fleshy, ovate, obovate, elliptic to broadly lanceolate, often dotted with blood-red spots, 5 - 12.5 × 2 - 5 cm, upper **L** smaller, tip obtuse, base cuneate, margins entire or irregularly crenate-serrate; **Inf** paniculate cymes; **Inf**, **Ped** and **Fl** densely clothed with glandular viscid **Ha**; **Fl** erect; **Cal** with the lobes free, lanceolate, acute to acuminate, 4 - 8 mm; **Cl** white, sometimes slightly tinged with pink, tube widened towards the base, 12 - 14 mm, lobes ovate-oblong, acute, mucronate, 6 - 9 mm; **NSc** white, linear, slightly bidentate, ± 3 mm; **Ca** ovoid, ± 5 mm.

K. orgyalis Baker (J. Bot. 20: 110, 1882). **T** [syn]: Madagascar (*Baron* 105 [K, P]). – **D**: S and SW Madagascar; xerophytic bush, on rocks and various soils. **I**: Hamet & Marnier-Lapostolle (1964: figs. 80-81); Boiteau & Allorge-Boiteau (1995: pl. 5: 12, 14). **Fig. XX.c**

Incl. *Kalanchoe antanosiana* Drake (1903).

[1] Perennial much-branched shrubs to 1 - 2 m tall, covered with very characteristic hair-**Sc** (i.e. stellate **Ha** with 3 rather long triangular acute branches), **Sc** generally very dense, often very appressed and ± limed with waxy secretion resulting in a glabrous appearance; stems erect, branched, stout, pilose when young; **L** petiolate, tough, densely pilose, grey-green to red-brownish above, green to silvery beneath, petiole canaliculate, 5 - 15 mm, lamina often folded like a gutter, ovate, ovate-spatulate, elliptic to lanceolate, 5 - 15 × 3.5 - 10 cm, tip acute, base attenuate, margins entire; **Inf** ± dense corymbose cymes, 45 - 100 cm; **Ped** 5 - 15 mm; **Fl** erect to spreading; **Cal** fleshy, tube almost absent, lobes ovate to orbicular, acute, ± cuspidate, 3 - 5 × 1.4 - 2.8 mm; **Cl** urceolate to 4-angled, very fleshy, yellow, glabrous or pilose, tube 6 - 15 mm, lobes spreading, ovate-deltoid, acutely cuspidate, 2.5 - 5 × 3 - 6 mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** ovate, 1.5 - 2 mm; **NSc** trapeziform to semi-orbicular, ± 1.5 mm; **Ca** 6.5 - 10 mm; **Sty** 2 - 2.5 mm; **Se** obovate, ± 0.7 mm.

A very decorative species easily cultivated and propagated. It often occurs together with *K. hildebrandtii* and *K. bracteata* but is easily distinguished.

K. paniculata Harvey (FC 2: 380, 1861). **T**: RSA, Free State (*Zeyher* 671 [S]). – **D**: Zimbabwe, Mozambique, RSA; stony, dry places. **I**: Hamet & Marnier-Lapostolle (1964: figs. 104-107); Tölken (1985: 68: fig. 8.1).

Incl. *Kalanchoe oblongifolia* Harvey (1861).

[1] Biennials, to 1.3 m tall, completely glabrous, with waxy-mealy pruinose cover; **R**stocks swollen; stems simple, erect, stout, almost 4-angled at the base; **L** subrosulate, subpetiolate or sessile, fleshy, petiole flat, to 5 cm, scarcely clasping, lamina oblong-ovate, broadly obovate, spatulate to subcircular, green to yellowish-green, ± tinged red, 6 - 20 ×

4 - 16 cm, tip obtuse to rounded, base attenuate, decurrent, margins entire; **Inf** dense flat-topped corymbose cymes or panicles, to 40 cm; **Ped** 4 - 7 mm; **Fl** erect; **Cal** green, tube 1 - 2 mm, lobes deltoid, acute, 1 - 3.5 × 1.5 - 2 mm; **Cl** tube cylindrical to almost pyramidal, distinctly 4-angled, enlarged towards the base, yellowish-green, 10 - 12 mm, lobes ovate, acutely apiculate, yellow-green, yellow to orange-yellow, finally reflexed, 2 - 4 × 1.5 - 3 mm; **St** inserted above the middle of the **Cl** tube, upper **St** exserted; **Anth** oblong to ovate, 0.7 - 1 mm; **NSc** oblong or linear, truncate or emarginate, 2.5 - 3 × ± 0.5 mm; **Ca** 8 - 9 mm; **Sty** 1 - 2 mm; **Se** ± 1 mm.

K. peltata (Baker) Baillon (Bull. Mens. Soc. Linn. Paris 1(59): 468, 1885). **T**: (*Hildebrandt* 3702 [K ?, LE [iso]]). – **D**: C and C-E Madagascar; deciduous and rain forests, shady and moist rocks, to 1600 m. **I**: Hamet & Marnier-Lapostolle (1964: pl. 1: D, figs. 6-7); Boiteau & Allorge-Boiteau (1995: 47); Rauh (1995a: figs. 403-405).

≡ *Kitchingia peltata* Baker (1883) ≡ *Bryophyllum peltatum* (Baker) Hort. ZSS (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Kalanchoe stapfii* Hamet & H. Perrier (1915) ≡ *Kalanchoe peltata* var. *stapfii* (Hamet & H. Perrier) H. Perrier (1928) ≡ *Kitchingia peltata* var. *stapfii* (Hamet & H. Perrier) A. Berger (1930); **incl.** *Kalanchoe mandrakensis* H. Perrier (1922) ≡ *Kitchingia mandrakensis* (H. Perrier) A. Berger (1930) ≡ *Kalanchoe peltata* var. *mandrakensis* (H. Perrier) Boiteau & Mannoni (1948); **incl.** *Kalanchoe peltata* var. *typica* Boiteau & Mannoni (1948) (*nom. inval.*, Art. 24.3).

[2/1] Perennials, entirely glabrous, to 1 - 2 m tall; stems usually simple, slender, erect, procumbent or decumbent; **L** petiolate, peltate, petiole slender, attached above the base of the lamina, subamplexicaul, 2 - 10 cm, lamina ovate to triangular, 3 - 12 × 2.5 - 7 cm, sometimes spotted with blackish, tip obtuse, base rounded, margins obscurely crenate to coarsely sinuate-dentate; **Inf** lax corymbiform panicles, 4 - 16 cm broad; **Ped** filiform, 0.6 - 4 cm; **Fl** pendent; **Cal** campanulate, pale green, tube 2 - 4.5 mm, lobes ovate to orbicular, 2 - 4 mm; **Cl** whitish, pink, pink-yellow, yellow-green or bright red, tube tubular-campanulate to urceolate, 22 - 32 mm, lobes ovate to orbicular, 6 - 10 × ± 6 mm; **St** inserted above the middle of the **Cl** tube, exserted; **Anth** reniform with divaricate lobes, ± 2 mm; **NSc** obovate to rectangular, 1.3 - 2 mm; **Ca** 6 - 8 mm; **Sty** ± 3 cm.

Intermediate between Sect. *Kalanchoe* (position of stamens, absence of bulbils) and Sect. *Bryophyllum* (pendent flowers, calyx tube ± as long as the lobes).

K. peteri Werdermann (RSN 39: 271, 1936). **T**: Tanzania, Pare Distr. (*Peter* 52046 [B †, B]). – **D**: NE Tanzania; rocky slopes, 1700 - 2100 m.

[1] Perennials, glabrous, pruinose; stems erect,

0.6 - 1.3 m tall; **L** petiolate, glaucous or glaucescent, petiole flattened and grooved above, 2 - 6 cm, lamina oblong or ovate, to 20 × 10 - 16 cm, reddish-blue, tip obtuse to rounded, base truncate or auriculate, margins crenate, bluntly serrate or dentate, subsinuate towards the tip; **Inf** racemose cymes to 20 cm; **Ped** 5 - 15 mm; **Fl** erect; **Cal** green, tube 0.5 - 2 mm, lobes lanceolate to triangular-subulate, 7 - 11 × 1.5 - 2.5 mm; **Cl** ivory-white, lower parts greenish-white, towards end of anthesis sometimes lobes propellerlike inflected, tube cylindrical, somewhat expanded at the base, 27 - 38 mm, lobes obovate, mucronate, 10 - 16 × 5 - 8 mm; upper **St** exserted; **Anth** oblong, 2 - 3 mm, with apical **Gl**; **NSc** linear-subulate, 4 - 13 mm; **Ca** linear-lanceolate in sideview, 12 - 18 mm; **Sty** 12 - 18 mm.

K. petitiana A. Richard (Tent. Fl. Abyss. 1: 311-312, 1847). **T**: Ethiopia (*Petit* s.n. [not located]). – **D**: Ethiopia.

Incl. *Kalanchoe petitaesii* A. Richard ex Jacques (1861) (*nom. inval.*, Art. 61.1?); **incl.** *Kalanchoe longiflora* var. *coccinea* Marnier-Lapostolle (1954) (*nom. inval.*, Art. 36.1).

[1] Perennials, glabrous or pubescent, forming dense stands, 30 - 70 cm tall (excl. **Inf**); stems terete, branched towards the tips, decumbent at the base, to 3 cm Ø; **L** petiolate, fleshy, petiole 2.5 - 4 cm, lamina broadly elliptic, obovate-oblong to ovate, 6 - 16 × 4 - 11 cm, tip rounded, base abruptly cuneate to subcordate, margins irregularly crenate to dentate; **Inf** dense, ± flat-topped, 60 - 200 cm; **Ped** 5 - 10 mm; **Fl** erect, sweet-scented; **Cal** tube 0.5 - 1 mm, lobes linear-deltoid, very acute, 7 - 12 × 1.3 - 2 mm; **Cl** pale yellow, magenta-pink to white with pink flush, tube cylindrical-conical, inflated at the base, 14 - 20 mm, lobes obtuse, long-mucronate, 6 - 7 × 3.5 - 5 mm; upper **St** exserted; **NSc** linear, 2.5 - 3.5 × 0.4 - 0.5 mm; **Ca** oblong, 7 - 12 mm; **Sty** 8 - 10 mm.

K. petitiana var. **neumannii** (Engler) Cufodontis (Webbia 19: 716, 1965). **T**: Ethiopia (*Neumann* 82 [B]). – **D**: W Ethiopia; montane forest margins, sometimes at rather wet sites, 2400 - 3000 m.

≡ *Kalanchoe neumannii* Engler (1907).

[1] Plants shortly glandular-pubescent throughout, usually densely so.

The fleshy leaves are used in baking local bread and in the preparation of a dressing for sores.

K. petitiana var. **petitiana** – **D**: Ethiopia; forest margins, open evergreen bushland, often in disturbed areas, 2000 - 3000 m. **I**: Gilbert (1989: 21, fig. 88.8: 11).

Incl. *Kalanchoe quartiniana* var. *micrantha* Pampanini (1909).

[1] Plants glabrous throughout.

K. pinnata (Lamarck) Persoon (Syn. Pl. 1: 446,

1805). **T**: Mauritius (cult.) (*Sonnerat* s.n. [P]). – **D**: Madagascar, now widely distributed as a garden escape throughout the tropics of Africa, Asia and America. **I**: Wickens (1987: 29: fig. 5); Boiteau & Allorge-Boiteau (1995: 129). **Fig. XX.d**

Incl. *Crassula pinnata* Linné fil. (1782); ≡ *Cotyledon pinnata* Lamarck (1786) ≡ *Vereia pinnata* (Lamarck) Sprengel (1825) ≡ *Bryophyllum pinnatum* (Lamarck) Oken (1841); **incl.** *Bryophyllum calycinum* Salisbury (1805) ≡ *Cotyledon calycina* (Salisbury) Roth (1821); **incl.** *Kalanchoe pinnata* var. *floripendula* Persoon (1805); **incl.** *Cotyledon calyculata* Solander ex De Candolle (1828) (*nom. inval.*, Art. 34.1c); **incl.** *Bryophyllum germinans* Blanco (1837); **incl.** *Kalanchoe floripendula* Steudel (1840); **incl.** *Crassulia floripendia* Commerson ex Hiern (1896) (*nom. illeg.*); **incl.** *Kalanchoe pinnata* var. *brevicalyx* Hamet & H. Perrier (1915) ≡ *Kalanchoe brevicalyx* (Hamet & H. Perrier) Boiteau ex Allorge-Boiteau (1995) (*nom. inval.*, Art. 33.2); **incl.** *Kalanchoe pinnata* var. *genuina* Hamet (1915) (*nom. inval.*, Art. 24.3); **incl.** *Kalanchoe pinnata* var. *calcicola* H. Perrier (1928) ≡ *Kalanchoe calcicola* (H. Perrier) Boiteau ex Allorge-Boiteau (1995) ≡ *Bryophyllum calcicola* (H. Perrier) Byalt (2000); **incl.** *Sedum madagascariensis* Clusius ex Fröderström (1936) (*nom. inval.*, Art. 34.1c); **incl.** *Kalanchoe macrodon* hort. ex H. Jacobsen (1954) (*nom. inval.*, Art. 34.1c); **incl.** *Kalanchoe madagascariensis* Allorge-Boiteau (1995) (*nom. inval.*, Art. 32.1c).

[2] Perennials, entirely glabrous, to 2 m tall; stems stout, erect; **L** petiolate, first simple, later pinnate to 3- to 5-foliate, leathery-fleshy, green, streaked with purple, edged with orange-red, petiole 2.5 - 7.5 cm, broadened towards the base and amplexicaul; lamina of simple **L** ovate to oblong, to 10 × 5 cm, tip obtuse, base cuneate to truncate, margins crenate-serrate, with bulbils produced from the sinuses; compound **L** 6 - 20 × 4 - 12 cm, leaflets ± similar to simple **L** or oblong-circular; **Inf** lax many-flowered panicles; **Ped** 10 - 12 mm; **Fl** pendent; **Cal** campanulate, green with red to violet lines, tube 20 - 30 mm, lobes ovate-triangular, acute-acuminate, 7 - 11 mm long and wide; **Cl** ± cylindrical, green below, red to greenish-reddish above, tube 25 - 40 mm, lobes oblong-ovate to triangular, acute, 9 - 14 × 4 - 6.5 mm; **St** inserted below the middle of the **Cl** tube, included; **Anth** ovate, 2.5 - 3 mm; **NSc** ± rectangular, 1.8 - 2.6 × 1.4 - 1.8 mm; **Ca** oblong-ovoid, 10 - 17 mm; **Sty** 22 - 30 mm; **Se** obovate, ± 0.8 mm.

This is the best-known species of the genus. It is certainly native to Madagascar, as it is a typical member of the Madagascan Sect. *Bryophyllum*. Today, it is found cultivated and as neophyte throughout the tropics of the world.

K. poincarei Hamet & H. Perrier (Bull. Acad. Int. Géogr. Bot. 23: 148-151, 1913). **T**: Madagascar

(Perrier 11816 [P]). – **D:** N Madagascar; rocks or sands, to 800 m. **I:** Hamet & Marnier-Lapostolle (1964: pl. 3: O, figs. 54-56, as *K. mortagei*); Boiteau & Allorge-Boiteau (1995: pl. 4: 2, 121); Rauh (1995a: figs. 997-998, as *K. mortagei*).

≡ *Bryophyllum poincarei* (Hamet & H. Perrier) Byalt (2000); **incl.** *Kalanchoe mortagei* Hamet & H. Perrier (1948) ≡ *Bryophyllum mortagei* (Hamet & H. Perrier) Wickens (1982) ≡ *Kalanchoe poincarei* var. *mortagei* (Hamet & H. Perrier) Boiteau (1995).

[2] Bi- to triennials, entirely glabrous, to 3 m; stems simple, erect or decumbent and rooting, whitish with minute red spots; **L** petiolate, glaucous, green to bluish-green, petiole amplexicaul, 1 - 5 cm, darker spotted, lamina narrowly ovate to lanceolate, sometimes red, 3 - 20 × 2.5 - 10 cm, tip obtuse to acute, base auriculate, margins crenate, ± sharply dentate in the upper part, with bulbils; **Inf** lax corymbose panicles, stout, erect, to 30 cm wide; peduncle to 50 cm tall; **Ped** slender, 6 - 18 mm; **Fl** pendent; **Cal** inflated, campanulate, oblong-round, red or red-green to yellow with red-purple lines, with a bluish bloom, tube 5 - 25 mm, lobes deltoid, acute, 7.5 - 9.5 × 6.7 - 9 mm; **Cl** tubular-campanulate, red, rose-purple, yellow or yellow-pink, tube ± 4-angled at the base, 17 - 19 mm, lobes obovate to lanceolate, very acute, 11 - 13 × 7 - 10 mm; **St** inserted below the middle of the **Cl** tube, upper **St** slightly exserted; **Anth** ovate-reniform, ± 2 mm; **NSc** obovate-square, emarginate, ± 2.5 × ± 1.4 mm; **Ca** ovate-lanceolate, 6 - 10 mm; **Sty** 19 - 25 mm; **Se** obovate, ± 0.5 mm.

This species is very close to *K. gastonis-bonnierei* on account of the habit, the inflorescence and the flowers with a large calyx (see also *K. suarezensis* and *K. macroclamys*).

K. porphyrocalyx (Baker) Baillon (Bull. Mens. Soc. Linn. Paris 1(59): 449, 1885). **T:** Madagascar (*Baron* 1708 [K]). – **D:** C and NE Madagascar; rain forests, generally epiphytic. **I:** Hamet & Marnier-Lapostolle (1964: pl. 3: N, figs. 117-118); Rauh (1995a: fig. 406). **Fig. XX.e**

≡ *Kitchingia porphyrocalyx* Baker (1883) ≡ *Bryophyllum porphyrocalyx* (Baker) A. Berger (1930); **incl.** *Kalanchoe sulphurea* Baker (1887) ≡ *Bryophyllum sulphureum* (Baker) A. Berger (1930) ≡ *Kalanchoe porphyrocalyx* var. *sulphurea* (Baker) Boiteau & Mannoni (1948) ≡ *Kitchingia sulphurea* (Baker) Boiteau & Allorge-Boiteau (1995) (*nom. inval.*, Art. 34.1c); **incl.** *Kalanchoe porphyrocalyx* var. *sambiranensis* Humbert ex Boiteau & Mannoni (1948); **incl.** *Kalanchoe porphyrocalyx* var. *typica* Boiteau & Mannoni (1948) (*nom. inval.*, Art. 24.3).

[2/1] Epiphytic or terrestrial small perennial herbs, much-branched, to 35 cm tall; stems slender, green, purple-tinged, erect or decumbent, 5 - 35 cm; **L** petiolate or subsessile, very polymorphic, glabrous, petiole 0 - 6 mm, lamina linear, ovate, obovate,

oblong, oblong-orbicular to orbicular, 2 - 6 × 0.6 - 4 cm, tip obtuse to rounded, base attenuate, margins irregularly crenate; **Inf** lax few-flowered (1 - 9 **Fl**) corymbose panicles, 3 - 11 cm; **Ped** 7 - 20 mm; **Fl** pendent; **Cal** green with red to violet lines, ± densely glandular-hairy, tube 1.5 - 4 mm, lobes lanceolate, deltoid to ovate, acute, 3 - 7 × 3 - 5.5 mm; **Cl** suburceolate, glabrous or slightly pubescent, tube red to rose pink, rarely lemon-yellow, 10 - 30 mm, lobes yellow-green, orange, ovate, reflexed, 3 - 8 × 2.5 - 6 mm; **St** inserted above the middle of the **Cl** tube, all **St** included; **Anth** ovate, 1 - 2 mm; **NSc** linear to ovate, emarginate, 2 - 3 × 0.7 - 1.6 mm; **Ca** oblong, 8 - 16 mm; **Sty** 7 - 16 mm; **Se** ± 0.7 mm, winged.

Depending on environmental conditions, this species is very variable as to length of stems, shape and size of leaves, as well as size and colour of flowers. This is one of the few epiphytes of the genus. The decorative plants are frequently cultivated, mostly in hanging baskets.

K. prittwitzii Engler (BJS 39: 463, 1907). **T:** Tanzania, Iringa Distr. (*Prittwitz & Gaffron* 267 [B]). – **D:** C and E Africa, Sudan, Ethiopia, Somalia; forest margins, open bush and grassland, on stony grounds or rocky slopes, 450 - 2300 m. **I:** Raads (1983: figs. 2b, 3b).

incl. *Kalanchoe dielsii* Hamet (1931) (*nom. inval.*, Art. 32.1c); **incl.** *Kalanchoe lugardii* Bullock (1932); **incl.** *Kalanchoe secunda* Werdermann (1935); **incl.** *Kalanchoe robynsiana* Hamet (1949).

[1] Perennials, glabrous, pruinose, to 0.4 - 2.3 m tall; stems erect or decumbent at the base; **L** petiolate, petiole flattened, mostly grooved above, slightly broadened at the base to semi-amplexicaul, 0.5 - 6 cm, lamina ovate, oblong or obovate, sometimes 3-lobed or 3-foliate, glaucous or glaucescent, sometimes with maroon or purple spots near the margin beneath, middle **L** 6 - 25 × 2.5 - 13 cm, tip obtuse, base cuneate, margins coarsely bluntly serrate to crenate or subentire; **Inf** lax many-flowered paniculate cymes to 35 × 20 cm; **Ped** 5 - 20 mm; **Fl** erect; **Cal** tube 0.5 - 2 mm, lobes lanceolate to lanceolate-subulate, 6 - 22 × 1.5 - 4 mm; **Cl** whitish or yellowish-green to cream with a yellow throat or yellow, rarely yellowish-pink, tube cylindrical, enlarged at the base, 13 - 28 mm, lobes oblong-ovate to ovate-lanceolate, mucronate, 6 - 18 × 3 - 7 mm; upper **St** inserted near the top of **Cl** tube and barely exserted, lower **St** inserted above the middle of the **Cl** tube; **Anth** oblong, 0.8 - 3 mm, with apical **Gl**; **NSc** linear-subulate, 2 - 9 mm; **Ca** linear-lanceolate in sideview, 7 - 14 mm; **Sty** 4 - 13 mm.

K. prolifera (Bowie ex Hooker) Hamet (Bull. Herb. Boissier, sér. 2, 8: 19, 1908). **T:** Madagascar (*Bowie* s.n. [K?]). – **D:** C Madagascar; on rocks, cultivated and often naturalized in numerous tropical countries. **I:** Berger (1930: fig. 197A-C); Hamet &

Marnier-Lapostolle (1964: figs. 60-62); Rauh (1995a: figs. 407-409). **Fig. XXI.c**

≡ *Bryophyllum proliferum* Bowie ex Hooker (1859).

[2] Perennials, entirely glabrous, stout, 0.8 - 3 m tall; stems robust, to 5 cm Ø, erect to procumbent, ± 4-angled, unbranched; **L** petiolate, green, fleshy, entire to pinnatisect or pinnate, to 30 cm overall, petiole enlarged to the base, amplexicaul, 5 - 12 cm, segments or leaflets asymmetrical and sessile, oblong, lanceolate to ovate-elongate, 7 - 15 × 1.5 - 5 cm, tip obtuse, margins crenate to dentate, often purple; **Inf** very large compound panicles, 40 - 80 × 20 - 40 cm, with up to 700 **Fl** and numerous aborted **Fl** and bulbils; **Ped** 8 - 15 mm, papillose; **Fl** pendent; **Cal** campanulate, green, papillose, tube 13 - 16 mm, lobes suborbicular, acuminate, 3 - 7 mm long and wide; **Cl** tubular, red, green or yellow, tube 15 - 25 mm, lobes ovate, acuminate, 2.7 - 4 × 3 - 4 mm; **St** inserted below the middle of the **Cl** tube, exserted; **Anth** ovate, 2 - 2.6 mm; **NSc** orbicular to trapeziform, 1.3 - 1.6 × 2 - 2.5 mm; **Ca** 7 - 8 mm; **Sty** 17 - 20 mm, exserted.

Used against rheumatism in Madagascar and often cultivated in tropical gardens. This taxon was also used for numerous anatomical and biological studies. Leaves attached to the plants do not normally produce bulbils, but when cut off, they become bulbilliferous.

K. pseudocampanulata Mannoni & Boiteau (Notul. Syst. (Paris) 13(1-2): 149-151, fig. 1, 1947). **T**: Madagascar (*Herb. Jard. Bot. Tananarive* 5057 [P]). – **D**: C and E Madagascar; forests, 1200 - 1500 m.

Incl. *Kalanchoe miniata* var. *decaryana* H. Perrier (1928).

[2] Perennials, entirely glabrous, to 1 m tall; stems erect, branched at the base; **L** somewhat fleshy, sessile, oblong, tip subacute, base attenuate and amplexicaul, or **L** panduriform or petiolate and obovate, margins minutely serrate in the upper ½; **Inf** lax, many-flowered, with numerous bulbils; **Ped** slender, 0.5 - 2 cm; **Fl** pendent; **Cal** campanulate, tube ± 2 mm, lobes deltoid, 6 - 9 × ± 6 mm; **Cl** campanulate, light to dark red, tube ± 9 mm, lobes ovate, obtuse to acute, spreading, ± 6 mm; **St** inserted below the middle of the **Cl** tube, included; **NSc** trapeziform, emarginate, ± 1.5 mm; **Ca** ± 5 mm; **Sty** ± 6 mm.

Perhaps nothing more than a simple form of *K. campanulata*.

K. pubescens Baker (JLSB 22: 470-471, 1887). **T**: Madagascar (*Baron* 3574 [K, P]). – **D**: C, S and SE Madagascar; forests and thickets, sunny and moist places, to 1600 m. **I**: Boiteau & Allorge-Boiteau (1995: 63); Rauh (1995a: figs. 410-412). **Fig. XXI.d**

≡ *Bryophyllum pubescens* (Baker) Hort. ZSS (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Kalanchoe ali-*

ciae Hamet (1910) ≡ *Bryophyllum aliciae* (Hamet) A. Berger (1930); **incl.** *Kalanchoe miniata* var. *anjirensis* H. Perrier (1928) ≡ *Kalanchoe pubescens* fa. *anjirensis* (H. Perrier) Allorge-Boiteau (1995) (*nom. inval.*, Art. 43.1); **incl.** *Kalanchoe miniata* var. *glandulosa* H. Perrier (1928); **incl.** *Kalanchoe miniata* var. *pubescens* H. Perrier (1928); **incl.** *Kalanchoe miniata* var. *tsinjoarivensis* H. Perrier (1928); **incl.** *Kalanchoe betsileensis* François (1938) (*nom. inval.*, Art. 32.1c); **incl.** *Kalanchoe pubescens* fa. *reducta* Humbert ex Boiteau & Mannoni (1948); **incl.** *Kalanchoe pubescens* var. *alexiana* Boiteau & Mannoni (1948); **incl.** *Kalanchoe pubescens* var. *brevicalyx* Boiteau & Mannoni (1948); **incl.** *Kalanchoe pubescens* var. *decolorata* Boiteau & Mannoni (1948); **incl.** *Kalanchoe pubescens* var. *grandiflora* Boiteau & Mannoni (1948); **incl.** *Kalanchoe pubescens* var. *subglabra* Boiteau & Mannoni (1948); **incl.** *Kalanchoe pubescens* var. *subsessilis* Boiteau & Mannoni (1948); **incl.** *Kalanchoe pubescens* var. *typica* Boiteau & Mannoni (1948) (*nom. inval.*, Art. 24.3).

[2] Perennials, robust, to 0.5 - 1.2 m tall, entirely and densely covered with white to reddish long simple glandular **Ha**; stems terete, erect, decumbent, sometimes prostrate, much-branched from the base, clear green, often streaked with red-purple; **L** fleshy, green, petiolate to sessile sometimes on the same plant (sessile towards the base), petiole flat, amplexicaul, 1 - 5 cm, lamina ovate, elliptic to orbicular, 3 - 15 × 0.5 - 9 cm, tip rounded to obtuse, base ± truncate, often auriculate, margins regularly crenate-dentate; **Inf** dense many-flowered corymbiform panicles, 15 cm wide, with bulbils; **Ped** slender, 10 - 12 mm; **Fl** pendent; **Cal** green with red-purple spots, tube 3 - 6 mm, lobes deltoid to ovate, acute, 2.5 - 7 × 3.8 - 4.8 mm; **Cl** campanulate, sometimes 4-angled, pink, red-orange to yellow, often lined with reddish, tube 14 - 30 mm, lobes ovate to triangular, obtuse to emarginate, 4 - 13 × 4 - 7 mm; **St** inserted below the middle of the **Cl** tube, exserted; **Anth** ovate, 1.2 - 1.8 mm; **NSc** oblong to rectangular, 1.2 - 2 mm; **Ca** 6 - 10 mm; **Sty** 13 - 18 mm; **Se** obovate, ± 0.7 mm.

This species presents pronounced variability in almost all plant parts. The numerous forms described by Boiteau & Mannoni (1948) are all of doubtful standing and are here tentatively synonymized.

K. pumila Baker (JLSB 20: 139-140, 1883). **T**: Madagascar, Centre (*Baron* 2117 [K, P]). – **D**: C Madagascar; on rocks, ± 2000 m. **I**: Boiteau & Allorge-Boiteau (1995: 173); Rauh (1995a: figs. 222, 414-416). **Fig. XXI.e**

Incl. *Kalanchoe multiceps* Baillon (1885); **incl.** *Kalanchoe brevicaulis* Baker (1887); **incl.** *Kalanchoe pumila* fa. *venustior* Boiteau ex Allorge-Boiteau (1995).

[1] Small perennial herbs, sometimes epiphytic,

forming dense tufts 20 - 30 cm tall, entirely glabrous; stems erect, much-branched, creeping, pruinose; **L** often crowded, fleshy, sessile or subsessile, obovate, entirely covered with a very fine farinose white wax, 2 - 4 × 1.5 - 2 cm, tip obtuse to subacute, base cuneate, margins purple, crenate in the upper part; **Inf** few-flowered corymbose panicles 2 - 7 cm wide; **Ped** 6 - 10 mm, waxy; **Fl** erect; **Cal** green or red-purple, pruinose, tube 0.5 - 1 mm, lobes deltoid to lanceolate, acute, 3 - 5 × 1.5 - 2.6 mm; **Cl** campanulate, red to purple or pink, tube 4 - 8.5 mm, lobes spreading, obovate to oblong, mucronate, 7 - 10 × 3 - 5 mm; **St** inserted towards the top of the **Cl** tube, slightly exserted; **Anth** reniform, 0.5 - 0.7 mm; **NSc** rectangular to oblong, emarginate, 1 - 2.5 × ± 0.6 mm; **Ca** 8 - 10 mm; **Sty** ± 1.5 mm; **Se** obovate, ± 1 mm.

Very attractive because of the whitish leaves and easily cultivated, esp. in hanging baskets.

K. quadrangularis Descoings (J. Bot. Soc. Bot. France 4: 89, 1997). **T**: Madagascar (*Herb. Réserve Naturelles* 12146 [P]). – **D**: N Madagascar (Ambilobé).

[1] Annuals (?) to 30 cm tall or more; stems simple, terete, slender; **L** unknown; **Inf** globose cymes, glabrous, 4 - 8 cm Ø, without peduncle; **Ped** terete, broadened below the **Fl**, 4 - 6 mm; **Fl** oriented in various directions, glabrous; **Cal** purple, tube 0.2 - 0.3 mm, lobes lanceolate to ovate-lanceolate, tip cuneate-acute, 9 - 10 × 3 - 4 mm; **Cl** tubularly 4-angled, purple, often greenish or whitish towards the base, tube square in cross-section, slightly widened at the base, 17 - 20 mm, lobes lanceolate to obovate-lanceolate, obtusely apiculate, 7 - 8 × 4 - 5.5 mm; upper **St** inserted at the base of the **Cl** lobes or towards the top of the **Cl** tube, lower **St** inserted 4 - 5 mm below the others; **Anth** oblong, 1.2 - 1.5 mm; **NSc** linear, obtuse, 3.5 - 4 mm; **Ca** oblong, 5 - 6 mm; **Sty** 10 - 14 mm.

Only known from a herbarium specimen without leaves.

K. quartiniana A. Richard (Tent. Fl. Abyss. 1: 311, pl. 54, 1847). **T**: Ethiopia, Tigre (*Quartin-Dillon* s.n. [P]). – **D**: N Ethiopia; forest margins, open evergreen bushland, often in disturbed areas, 2100 - 2600 m. **I**: Gilbert (1989: 21, fig. 88.8: 3).

[1] Perennials, entirely glabrous, glaucous, to 70 cm tall; stems simple, erect, robust, terete, branched at the top; **L** petiolate, petiole amplexicaul, 2.5 - 6 cm, lamina ovate, obovate, obovate-oblong or elliptic, 10 - 18 × 8 - 10 cm, tip obtuse, margins irregularly crenate; **Inf** lax much-branched cymose panicles; **Ped** slender, 10 - 25 mm; **Fl** erect; **Cal** tube 1.7 - 2.2 mm, lobes lanceolate, acute, membranous, slightly spreading, 6 - 12 × 3 - 5 mm; **Cl** pure white, yellow to pale pink, tube cylindrical, inflated towards the base, 30 - 50 mm, lobes ovate, abruptly acuminate (acumen ± 1 mm), 10 - 20 × 6 - 7 mm; **St**

inserted above the middle of the **Cl** tube, upper **St** exserted; **Anth** ± 1 mm; **NSc** linear, obtuse to emarginate, 4 - 8 × 0.5 - 0.7 mm; **Ca** ovate-lanceolate in sideview, 14 - 20 mm; **Sty** 14 - 30 mm.

Very close to *K. petitiiana* and *K. peteri*.

K. rechingeri Hamet ex Rauh & Hebding (Succulentes 18(1): 16-18, ill., 1995). **T**: Madagascar (*Anonymus* s.n. in *BG Heidelberg* 74213 [HEID]).

This appears to represent the hybrid *K. beauverdii* × *K. delagoensis* or *K. rosei*.

K. rhombopilosa Mannoni & Boiteau (Notul. Syst. (Paris) 13(1-2): 153-154, ill. (p. 151), 1947). **T** [syn]: Madagascar, Sud-Ouest (*Montagnac* s.n. [P]). – **D**: SW Madagascar; xerophytic bush, shady places. **I**: Hamet & Marnier-Lapostolle (1964: figs. 126-128); Boiteau & Allorge-Boiteau (1995: 171). **Fig. XX.f**

Incl. *Kalanchoe rhombopilosa* var. *argentea* Rauh (1997); **incl.** *Kalanchoe rhombopilosa* var. *viridifolia* Rauh (1997).

[1] Small perennials, little-branched, 10 - 20 cm tall; stems thick, woody, erect or spreading, pilose; **L** alternate or opposite, petiolate, fleshy, 2 - 3 mm thick, pruinose, grey, grey-green, green-yellow with numerous dark spots or dark green without spots, ± densely covered with silvery scaly **Ha**, petiole 1 - 2.5 mm, lamina obovate to ± triangular, upper face slightly concave, lower face convex, 1 - 3 × 1 - 2.5 cm towards the tip, tip rounded and irregularly sinuate-crenate, base strongly attenuate-cuneate; **Inf** narrow ramose panicles, 8 - 12 cm, glabrous; **Ped** 1.2 - 2.6 mm; **Fl** erect; **Cal** green-yellow, tube 0.2 - 0.3 mm, lobes orbicular to oblong, 1.2 - 1.5 × 1.2 - 1.4 mm; **Cl** green-yellow to pink with red-purple lines, tube 3.5 - 4 mm, lobes ovate, obtuse, 2 - 3 × 1.5 - 2 mm; **St** inserted slightly above the middle of the **Cl** tube, exserted; **Anth** ovate, ± 0.6 mm; **NSc** ± quadrangular, ± 0.4 mm; **Ca** 3 - 3.5 mm; **Sty** ± 2.5 mm; **Se** oblong, ± 0.8 mm.

This slow-growing species has a very characteristic habit and leaf colour. Variability in leaf size and colour is considerable, and the plants appear to flower but rarely. The recently described varieties by Rauh & Hebding (1997) are difficult to accept in view of the pronounced variability in leaf colour, and they are here tentatively placed in synonymy.

K. robusta Balfour fil. (Proc. Roy. Soc. Edinburgh 11: 512, 1882). **T**: Socotra (*Balfour & al.* 151 [K]). – **D**: Socotra; rocky slopes amongst limestone or granite boulders, 300 - 550 m. **I**: EJ 9: 196, 1994; Miller & Cope (1996: 476, fig. 91A). **Fig. XXI.f**

Incl. *Kalanchoe abrupta* Balfour fil. (1882).

[1] Perennials, entirely glabrous, to 50 cm tall; stems terete, robust, 1 - 3 cm Ø at the base, grey, sparsely branched; **L** petiolate, fleshy, crowded towards the **Br** tips, petiole 5 - 10 mm, lamina obovate, oblong-obovate to spatulate, 3.5 - 9 × 2.5 - 4 cm, glaucous, tip acute to obtuse, base atte-

nuate, margins entire and reddish; **Inf** ± dense panicles; **Ped** 6 - 12 mm; **Fl** held horizontally; **Cal** glaucous-green, tube 1.5 - 1.7 mm, lobes triangular, acuminate, sometimes sparsely glandular, 3 - 5 × 2 - 3 mm; **Cl** bright orange-scarlet, tube cylindrical, contracted at the base, slightly curved and zygomorphic, 12 - 35 mm, lobes ovate-oblong, rounded, apiculate, 6 - 10 × 3 - 5 mm; **St** inserted a little above the middle of the **Cl** tube, all exserted; **NSc** suborbicular, obtuse or slightly emarginate, 1 - 3 × 1.5 - 1.8 mm; **Ca** ovate-lanceolate in sideview, 6 - 20 mm; **Sty** 5 - 12 mm.

The horizontally spreading (intermediate between Sect. *Kalanchoe* and Sect. *Bryophyllum*) slightly zygomorphic flowers are notable. The species appears close to *K. elizae*.

K. rolandi-bonapartei Hamet & H. Perrier (Ann. Sci. Nat. Bot., sér. 9, 16: 361-363, 1912). **T**: Madagascar (Perrier 11826 [P]). – **D**: N Madagascar; on rocks. **I**: Hamet & Marnier-Lapostolle (1964: figs. 129-130).

Incl. *Kalanchoe tsaratananensis* H. Perrier (1928) ≡ *Bryophyllum tsaratananense* (H. Perrier) A. Berger (1930).

[2] Perennials, robust, to 2 m tall, covered with minute **Ha** but appearing glabrous; stems stout, 3 - 5 mm Ø, erect to decumbent, much-branched; **L** petiolate to subsessile, dark green-olive, petiole slender, broadly amplexicaul, 1 - 3.5 cm, lamina ovate-oblong to ovate-lanceolate, 5 - 25 × 2 - 7 cm, tip very obtuse, base ± cordate or cuneate, auriculate, margins dentate to doubly crenate-dentate; **Inf** lax panicles, 6 - 20 cm, producing bulbils; **Ped** slender, glabrous, 8 - 12 mm; **Fl** pendent; **Cal** glabrous, green to brown-reddish, tube 1 - 3 mm, lobes ovate to deltoid, acute, 6 - 7 × 2.7 - 3.2 mm; **Cl** tubular to campanulate, yellow-green, yellow-reddish to orange, red-lined, slightly pilose glandular, tube ± 4-angled towards the base, 10 - 18 mm, lobes ovate, obtuse, 6 - 8 × 6 - 7 mm; **St** inserted below the middle of the **Cl** tube, slightly exserted; **Anth** reniform, yellow, ± 1.6 mm; **NSc** ± rectangular, emarginate, ± 1 × 1.2 - 1.6 mm; **Ca** ovate-lanceolate in sideview, 7.5 - 8 mm; **Sty** 8 - 12 mm.

Insufficiently known species, appearing close to *K. pubescens*.

K. rosei Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 2: 132-135, 1914). **T**: Madagascar (Perrier 11825 [P]). – **D**: C-S and SE Madagascar; moist rocks. **I**: Boiteau & Allorge-Boiteau (1995: 97, 99; 163, as *K. mandrarensis*).

≡ *Bryophyllum rosei* (Hamet & H. Perrier) A. Berger (1930); **incl.** *Kalanchoe bouvieri* Hamet & H. Perrier (1912); **incl.** *Kalanchoe rosei* ssp. *serratifolia* Humbert (1933); **incl.** *Kalanchoe rosei* ssp. *variifolia* Guillaumin & Humbert (1941); **incl.** *Kalanchoe rosei* var. *seyrigii* Boiteau & Mannoni (1949).

[2] Perennials to biennials, entirely glabrous, to 1.8 m tall; stems simple, erect, brownish-green; **L** petiolate, polymorphic, grey-green to pale reddish, slightly spotted, petiole 2 - 16 mm, lamina thick, mostly lanceolate to oblong-lanceolate, or linear-lanceolate, pinnatisect, hastate-trilobate (lobes triangular, obtuse), 6 - 17 × 0.5 - 1.5 cm, tip acute, base cuneate, margins irregularly sinuate-serrate, with bulbils; **Inf** lax panicles, 15 - 30 cm; **Ped** slender, 1.5 - 2.5 cm; **Fl** pendent; **Cal** subcampanulate, pink, tube 10 - 12 mm, lobes deltoid, 5 - 6 mm long and wide; **Cl** tubular, deep pink tinged yellow, tube slightly 4-angled, 24 - 30 mm, lobes ovate to lanceolate, obtuse, 5 - 6 mm long and wide; **St** inserted below the middle of the **Cl** tube, exserted; **Anth** ovate, yellow, ± 2 mm; **NSc** oblong, emarginate, ± 1.6 × 1 mm; **Ca** ovoid, 6 - 7 mm; **Sty** 18 - 22 mm; **Se** obovate, ± 0.6 mm.

In view of the overall variability, the described varieties cannot be upheld. The species appears to hybridize easily, esp. with *K. fedtschenkoi* and *K. daigremontiana*.

K. rotundifolia (Haworth) Haworth (Philos. Mag. J. 66: 31, 1825). **T**: K [unpubl. ill. s.n. Oct. 1823]. – **D**: Widespread from C and E to S and SW Africa, Socotra; woodlands, open and secondary forests, savannas, open veld, in various habitats in shade or half-shade. **I**: Tölken (1985: 64, fig. 7); Miller & Cope (1996: fig. 91B).

≡ *Crassula rotundifolia* Haworth (1824) ≡ *Vereia rotundifolia* (Haworth) D. Dietrich (1840); **incl.** *Meristostylus brachycalyx* Klotzsch (1861); **incl.** *Kalanchoe integerrima* Lange (1872); **incl.** *Kalanchoe luebbertiana* Engler (1907); **incl.** *Kalanchoe seilleana* Hamet (1916); **incl.** *Kalanchoe guillauminii* Hamet (1948); **incl.** *Kalanchoe rotundifolia* var. *tripartita* Hamet (1956) (*nom. inval.*, Art. 36.1, 37.1); **incl.** *Kalanchoe rotundifolia* var. *peltata* Hamet (1960) (*nom. inval.*, Art. 36.1, 37.1); **incl.** *Kalanchoe decumbens* Compton (1967); **incl.** *Kalanchoe rotundifolia* fa. *peltata* Hamet ex R. Fernandes (1978); **incl.** *Kalanchoe rotundifolia* fa. *tripartita* Hamet ex R. Fernandes (1978).

[1] Perennials or sometimes annuals, completely glabrous, pruinose, 0.2 - 2 m tall; stems usually simple, terete, erect or decumbent at the base; **L** petiolate to sessile, petiole subcylindrical, easily detachable from the stem, to 12 mm, lamina oblong, lanceolate, elliptic, spatulate or triangular, pale green to blue-green, 1 - 8.5 × 0.5 - 5.5 cm, tip acute to rounded, base cuneate, margins entire, sinuate, dentate, crenate or ± deeply 3-lobed; **Inf** few-flowered corymbose or paniculate cymes, 2 - 40 cm; **Ped** 2 - 8 mm; **Fl** erect; **Cal** tube 0.1 - 1 mm, lobes lanceolate or triangular, acute, 0.5 - 2 × 0.5 - 1 mm; **Cl** deep red to orange, yellowish to greenish in the lower part, tube urceolate, globose in the lower part, twisted in the upper part after anthesis, 6 - 10 mm, lobes lanceolate or elliptic, very acute,

spreading, 2.5 - 5 × 1 - 2.5 mm, tips twisted; **St** inserted above the middle of the **Cl** tube, included; **Anth** oblong, 0.3 - 0.8 mm, with apical **Gl**; **NSc** linear, 1 - 3.5 mm; **Ca** linear-lanceolate in sideview, 4 - 7 mm; **Sty** 0.3 - 1 mm; **Se** obovate, 0.6 - 1 mm.

A very complex and polymorphic species. A distinction must be made between local geographical variations and the very marked seasonal variations, which are apparently induced by environmental factors. Numerous forms and varieties have been described, which are all tentatively synonymized here.

K. rubella (Baker) Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 3: 111-114, 1915). **T**: Madagascar (*Baron* 5853 [K]). – **D**: C and E Madagascar; humid places in forests. **I**: Hamet & Marnier-Lapostolle (1964: figs. 63-64); Boiteau & Allorge-Boiteau (1995: 127, pl. 5: 9-10).

≡ *Bryophyllum rubellum* Baker (1889).

[2] Perennials, entirely glabrous, to 1 - 2 m tall; stems 4-angled with numerous white lenticels; **L** petiolate, fleshy, imparipinnate, petiole widened, broadly amplexicaul, ± 5 cm, leaflets 3 - 9, sessile or with conspicuous petiolule, dark green with white spots, asymmetrically oblong-ovate, 4 - 12 × 2 - 5 cm, somewhat red beneath, tip obtuse, base cuneate, margins deeply crenate; **Inf** lax panicles with ± 100 **Fl**; peduncle ± 30 cm; **Ped** 12 - 23 mm, pink; **Fl** pendent; **Cal** subcampanulate, membranous, yellow-green with red-purple lines, tube 14 - 16 mm, lobes deltoid, acute, cuspidate, 6 - 8 × 7 - 8.5 mm; **Cl** bright red, orange to yellow, tube ± cylindrical, 22 - 23 mm, lobes oblong-semiorbicular, acuminate, 5 - 6 mm long and wide; **St** inserted below the middle of the **Cl** tube, included; **Anth** ovate, emarginate, ± 2.5 mm; **NSc** linear-oblong, emarginate, ± 2.5 × 0.7 mm; **Ca** 5 - 6 mm; **Sty** 15 - 18 mm.

Very close to *K. prolifera* and *K. pinnata*, esp. in habit, leave size and form, and flower structure.

K. salazarii Hamet (Bol. Soc. Brot., sér. 2, 37: 14, t. 1, 1963). **T**: Angola (*Silva Monteiro* 4 [COI]). – **D**: Angola (Huila). **I**: Hamet (1931-1963: tt. 86-87, 1963).

[1] Perennials, entirely glabrous, to 1 m tall; stems simple, erect, terete, robust, to 15 mm Ø at the base, reddish; **L** sessile, weekly fleshy, lanceolate, oblong-lanceolate to oblong-linear, 11 - 24 × 1.2 - 4 cm, tip acute, base enlarged and ± amplexicaul, margins entire, green-brownish; **Inf** dense many-flowered panicles, 10 - 16 cm; **Ped** slender, 3 - 8 mm; **Fl** ascending; **Cal** tube 1.1 - 1.3 mm, lobes deltoid, acute, 2 - 2.5 × 1.4 - 1.9 mm; **Cl** suburceolate, tube lined with dark-red, 5 - 8 mm, lobes ovate, ovate-oblong, cuspidate, erect, 1.2 - 2.4 × 1 - 1.8 mm; **St** inserted above the middle of the **Cl** tube, upper **St** slightly exserted; **Anth** ovate-oblong, 0.6 - 1 mm, with a little globule at the tip; **NSc** linear, deeply emarginate, 2.1 - 2.6 × 0.4 - 0.5 mm; **Ca** ov-

ate-oblong, 5 - 7 mm; **Sty** very short, 0.45 - 0.65 mm; **Se** obovate, ± 0.8 mm.

K. sanctula Descoings (J. Bot. Soc. Bot. France 4: 87, 1997). **T**: Madagascar, Taolanaro (*Descoings* 28180 [P]). – **D**: SE Madagascar (region of Taolanaro); wooded hills, sunny places.

[2] Biennials to perennials, entirely glabrous; stems simple, terete, straight, erect, 20 - 50 cm tall, 6 - 10 mm Ø; **L** petiolate, thick, fleshy, yellowish-green with a brownish-red edging along the margins and spots of the same colour beneath near the margins, petiole subterete, slightly widened at the base, 2 - 3 cm, lamina ovate-oblong to ovate-elliptic, 6 - 8 × 3 - 4 cm wide, tip cuneate to ± rounded, base rounded, flat in young **L**, erect to form a large auricle in adult **L** which become almost peltate, margins regularly serrate, with numerous bulbils; **Inf** many-flowered corymbose cymes, 15 - 20 cm; **Ped** slender, curved, 6 - 25 mm; **Fl** pendent, white-yellowish to purplish-blue; **Cal** tube ± 4-angled, 3.5 - 4 mm, lobes deltoid, acute, 4 - 5 × 2.5 - 3 mm; **Cl** oblong-cylindrical, tube ± 4-angled, abruptly narrowed towards the lower ¼, 20 - 30 mm, lobes obovate, tips rounded-apiculate, 6 - 8 × 4 - 5 mm; **St** inserted at the inferior ¼ of the **Cl** tube, slightly exserted; **Anth** ovate, 0.5 - 1 mm; **NSc** trapezoid, bilobate at the tip, 1.2 - 1.5 × 0.8 - 1 mm; **Ca** oblong-ovate, 4 - 5 mm; **Sty** 16 - 23 mm.

The overall colour of the plants and the beautiful flowers make this a very attractive species, which is moreover of easy cultivation and propagation.

K. scapigera Welwitsch ex Britten (FTA 2: 397, 1871). **T**: Angola, Moçamedes Distr. (*Welwitsch* 2483 [LISU]). – **D**: Angola (Moçamedes); xeric places in stony soils, or among or on rocks, 50 - 60 m. **I**: Fernandes (1982: 30: pl. 2).

[1] Small perennials, glabrous; **R** thick, woody; stems woody, ± branched, terete, thick, rugose, 2 - 3 cm tall; **L** ± rosulate at the stem tips, sessile or subsessile, obovate to suborbicular, 2.7 - 4 × 1.2 - 2 cm, very thick, reddish to yellow-copper-coloured, tip obtuse to rounded, base constricted then semi-amplexicaul; **Inf** dense, corymbiform, 3.5 - 5 cm; peduncle to 35 cm; **Ped** rigid, 2 - 6 mm; **Fl** rather fleshy, deep yellow, erect; **Cal** tube ± 0.4 mm, lobes lanceolate, acute, 1 - 1.5 mm; **Cl** tube 4-angled, rounded at the base, 8 - 12 mm, lobes ovate, apiculate, ± 3 × 1 mm; **St** inserted above the middle of the **Cl** tube, all included; **Anth** ovate, ± 0.6 mm; **NSc** linear, acute to emarginate, 2 - 4 mm; **Ca** oblong, 5 - 10 mm; **Sty** 0.5 - 0.7 mm.

Rather close to but amply distinct from *K. farinacea* which is endemic to Socotra. Also somewhat similar to *K. rotundifolia* from the Cape (RSA).

K. schimperiana A. Richard (Tent. Fl. Abyss. 1: 310, 1847). **T**: Ethiopia, Tigre (*Schimper* 388 [P, B, BM, FI, G, K, M, W]). – **D**: Ethiopia, E Tanzania; on rocks, 900 - 2100 m. **I**: Hamet & Marnier-Lapo-

stolle (1964: figs. 110-111); Gilbert (1989: fig. 88.8: 7).

Incl. *Kalanchoe schliebenii* Werdermann (1935).

[1] Perennials, 0.4 - 1 m tall; stems glandular-pubescent or glabrous below and pubescent above; **L** petiolate, generally glandular-pubescent, sometimes glabrous, petiole to 2 - 3 cm, lamina ovate to subcircular, 10 - 11 × 8 - 10 cm, tip obtuse, base abruptly contracted into the petiole, margins crenate to crenate-serrate; **Inf** few-flowered, corymbose, densely glandular-hairy, sticky, to 20 cm; **Ped** 5 - 20 mm; **Fl** erect, ± densely glandular-pubescent; **Cal** green, tube 1 - 4 mm, lobes lanceolate, acute, acuminate, 10 - 40 × 3 - 6 mm; **Cl** white, often veined with yellow-green, tube 50 - 65 mm, lobes oblong-ovate to broadly obovate, acutely mucronate, 10 - 30 × 8 - 15 mm; **St** inserted in the upper part of the **Cl** tube, included or almost so; **Anth** oblong, 2 - 3 mm, with apical **Gl**; **NSc** linear-subulate, bifid, 3.5 - 7 × ± 1 mm; **Ca** oblong-lanceolate in sideview, 18 - 22 mm; **Sty** 32 - 40 mm.

K. schizophylla (Baker) Baillon (Bull. Mens. Soc. Linn. Paris 1(59): 469, 1885). **T:** Madagascar (*Baron* 3132 [K]). – **D:** C Madagascar; humid places in forests. **I:** Boiteau & Allorge-Boiteau (1995: 85); Rauh (1995a: figs. 418-420).

≡ *Kitchingia schizophylla* Baker (1884) ≡ *Bryophyllum schizophyllum* (Baker) A. Berger (1930).

[2] Climbing perennials, entirely glabrous, sometimes epiphytic; stems terete, slender, somewhat woody at the base, climbing, to 3 - 8 m; **L** petiolate, pinnate, petiole narrow, amplexicaul, 3 - 5 mm, lamina variable in shape, base longish attenuate, segments in 6 - 8 pairs, linear, subentire, obtuse at the tip, recurved, 8 - 15 cm; **Inf** very large, few-flowered panicles producing bulbils; **Ped** slender, flexuose, 4 - 8 mm; **Fl** pendent; **Cal** campanulate, green, tube 1.5 - 2 mm, lobes deltoid, acutely cuspidate, 3 - 3.5 × 2.7 - 3 mm; **Cl** urceolate to campanulate, bright red to violet, tube ± 4-angled, 13 - 17 mm, lobes oblong-ovate, emarginate, 1.5 - 4 × ± 2 mm; **St** inserted below the middle of the **Cl** tube, fairly much exserted; **Anth** ± 1 mm; **NSc** ± rectangular, ± 1.5 mm long and wide; **Ca** ± 7.5 mm; **Sty** ± 10 mm, exserted; **Se** obovate, ± 0.7 mm.

This is one of the few climbing species of the genus, together with *K. beauverdii*. The variable leaves are very decorative and the plants are easily cultivated.

K. serrata Mannoni & Boiteau (Notul. Syst. (Paris) 13(1-2): 151-153, ill., 1947). **T:** Madagascar, Centre (*Herb. Jard. Bot. Tananarive* 5054 [P, TAN]). – **D:** C-S Madagascar (Andringitra Massif). **I:** Boiteau & Mannoni (1949: 74); Boiteau & Allorge-Boiteau (1995: 97).

≡ *Bryophyllum serratum* (Mannoni & Boiteau) Lauzac-Marchal (1974) (*nom. illeg.*, Art. 53.1); **incl.** *Bryophyllum lauzac-marchaliae* Byalt (1999).

[2] Perennials, entirely glabrous, forming dense tufts, 30 - 60 cm tall; stems creeping at the base and rooting, later erect, terete, with small wings under the **L**, purple; **L** petiolate to subsessile, fleshy, glaucous, green-bluish, red-spotted, petiole to 1 cm, ± amplexicaul, often brown-spotted, lamina elliptic to ovate, 4 - 6 × 2.5 - 4.5 cm, tip obtuse, base auriculate, margins purple, finely dentate-serrate with acute teeth, producing bulbils; **Inf** lax cymes; peduncle 20 - 30 cm; **Ped** slender, 20 - 30 mm; **Fl** pendent; **Cal** cylindrical, tube 14 - 16 mm, lobes deltoid, acute, ± 7 mm; **Cl** red-orange to golden-yellow, tube cylindrical, ± 4-angled at the base, 20 - 23 mm, lobes orbicular, ± 5 × 4 mm; **St** inserted below the middle of the **Cl** tube, included; **NSc** deltoid, emarginate, 1.3 - 1.8 mm; **Ca** oblong, ± 10 mm; **Sty** ± 20 mm.

K. sexangularis N. E. Brown (BMI 1913: 120, 1913). **T:** RSA, Transvaal (*Thorncroft* s.n. [CGG]). – **D:** Zimbabwe, Moçambique, RSA; rocky slopes in shade or semishade of trees or shrubs in bushland. **I:** FPA 47: pl. 1878, 1983.

Incl. *Kalanchoe hexangularis* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Kalanchoe mocambicana* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Kalanchoe rogersii* Hamet (1915); **incl.** *Kalanchoe vatrinii* Hamet (1916); **incl.** *Kalanchoe mossambicana* Resende ex Resende & Sobradinho (1952); **incl.** *Kalanchoe rubinea* Tölken (1978); **incl.** *Kalanchoe vatrinii* var. *intermedia* R. Fernandes (1980) ≡ *Kalanchoe sexangularis* var. *intermedia* (R. Fernandes) R. Fernandes (1982).

[1] Perennials, sparsely succulent, completely glabrous, 0.2 - 1 m tall; stems 1 or few, from a woody base, simple, erect, terete or somewhat 2- to 6-angled, reddish; **L** ± distinctly petiolate, fleshy, green to reddish, petiole 4 - 45 mm, canaliculate, not amplexicaul in lower **L** but distinctly so in upper **L**, lamina broadly elliptic, oblong or ovate, green to deep ruby-red, 5 - 13 × 3 - 8 cm, tip rounded or obtuse, base cordate in lower **L**, cuneate in upper **L**, margins coarsely crenate or undulate-crenate, sometimes with 1 - 4 obtuse toothed lobes; **Inf** lax flat-topped panicles to 30 cm; **Ped** 2 - 7 mm; **Fl** erect, green-yellow to bright yellow; **Cal** green, tube 0.5 - 2 mm, lobes triangular, acute, 1.5 - 2.2 × ± 1.2 mm; **Cl** tube 4-angled-cylindrical to almost pyramidal, enlarged in lower ½, pale pink, 8 - 13 mm, lobes broadly ovate to subcircular, attenuate or rounded at the tip, salmon, 2 - 4 × 1.5 - 3 mm; **St** inserted towards the top of the **Cl** tube, upper **St** exserted; **Anth** suborbicular, 0.4 - 1 mm; **NSc** linear-lanceolate, acute, 1.6 - 4 mm; **Ca** 6.5 - 10 mm; **Sty** 1.7 - 4 mm; **Se** 1 - 1.3 mm.

The var. *intermedia* is here provisionally placed in synonymy because of the general variation observed in the species.

K. spatulata De Candolle (Pl. Hist. Succ. t. 65 +

text, 1801). – **D:** Widespread in Asia (India, Himalaya, Thailand, Burma, Malaysia, Vietnam, China, Taiwan, Philippines, Japan); rocky places, 300 - 1500 m. **I:** Liu & Chung (1977: 15: pl. 462); Fu & Fu (1984: 12, figs. 18-23).

≡ *Cotyledon spathulata* (De Candolle) Poirlet (1811); **incl.** *Vereia acutiflora* Andrews (1809) ≡ *Kalanchoe acutiflora* (Andrews) Haworth (1812); **incl.** *Kalanchoe varians* Haworth (1829); **incl.** *Bryophyllum serratum* Blanco (1837); **incl.** *Bryophyllum triangulare* Blanco (1837); **incl.** *Cotyledon lanceolata* Blanco (1837) (*nom. illeg.*, Art. 53.1); **incl.** *Kalanchoe nudicaulis* Hamilton ex C. B. Clarke (1879).

[1] Perennials, glabrous or glandular-pubescent above, 30 - 120 cm tall; stems stout, 5 - 15 mm Ø, terete to almost 4-angled, erect or decumbent; **L** sessile or subpetiolate, fleshy, glabrous, ovate, oblong to spatulate-oblong, 3 - 25 × 1.5 - 10 cm, lower **L** subpetiolate, upper **L** more distant, becoming very narrow, sometimes 3-foliolate, tip attenuate-obtuse, base amplexicaul or widened into a very short petiole, margins entire to slightly dentate or irregularly crenate; **Inf** terminal or axillary dense many-flowered cymose panicles 5 - 20 cm wide; **Ped** 5 - 20 mm; **Fl** erect; **Cal** tube ± 1 mm, lobes triangular, oblong to lanceolate, acute to acuminate, 4 - 10 × ± 2 mm; **Cl** clear yellow, urceolate, glabrous, tube cylindrical to almost 4-angled, widened at the base, 10 - 25 mm, lobes spreading, broadly lanceolate to elliptic-ovate, acute or shortly acuminate, 8 - 10 × 4 - 5 mm; **St** inserted in the upper part of the **Cl** tube, slightly exserted to almost included; **Anth** ovate to orbicular, 0.7 - 1 mm; **NSc** linear, 3 - 5 mm, often bifid; **Ca** narrowly oblong, 5 - 9 mm; **Sty** 2.5 - 3 mm; **Se** reddish-brown, oblong, ± 0.7 mm.

This is the only Asiatic taxon with a wide distribution throughout the tropical and subtropical regions of Asia. It is regarded as a cure for cholera in India and is reportedly strongly purgative. For goats and cattle, plants of this species appear to be toxic. Leaves and the juice of the plant are variously used medicinally.

K. stenosphon Britten (FTA 2: 395, 1871). **T:** Ethiopia, Tigre (*Schimper* 726 [BM]). – **D:** N Ethiopia; limestone slopes, 1600 - 2300 m. **I:** Gilbert (1989: 21, fig. 88.8: 9).

[1] Perennials, entirely glabrous, 30 - 60 cm tall; stems terete; **L** petiolate, lamina lanceolate, reddish-green, ± 10 × 1.5 cm, tip acute, base cuneate, relatively broad, margins subentire; **Inf** elongate very lax few-flowered panicles to 60 cm; **Ped** 5 - 12 mm; **Fl** erect; **Cal** tube almost none, lobes lanceolate, subacute, somewhat membranous, ± 6.5 × 1.5 - 2.8 mm; **Cl** yellow-green, tube narrowly conical, much inflated and truncate below, very slender in the upper portion, 14 - 16 mm, lobes linear-lanceolate, acuminate, 7 - 11 × 1.3 - 2 mm; **St** inserted above the middle of the **Cl** tube, included; **NSc** linear,

acuminate, 3.5 - 5 mm; **Ca** 10 - 12 mm; **Sty** 2 - 2.5 mm.

This ill-known species is perhaps nothing more than a form of *K. glaucescens*.

K. streptantha Baker (JLSB 22: 472, 1887). **T:** Madagascar (*Baron* 4874 [K, P]). – **D:** C-W Madagascar; sunny rocky places. **I:** Hamet & Marnier-Lapostolle (1964: figs. 68-69); KuaS 44: 181-185, 1993; Boiteau & Allorge-Boiteau (1995: 113).

≡ *Bryophyllum streptanthum* (Baker) A. Berger (1930) ≡ *Kitchingia streptantha* (Baker) Allorge-Boiteau (1995).

[2] Perennials, entirely glabrous, robust, to 1.2 m tall; stems stout, 2 - 3 cm Ø, decumbent, branched at the base; **L** shortly petiolate to subsessile, thick, fleshy, light green to green-bluish, edged with red to brownish, covered with a whitish bloom and glaucous, petiole 5 - 10 mm, slightly amplexicaul, lamina oblong-lanceolate, obovate to obovate-lanceolate, 4 - 15 × 1 - 7.5 cm, violet-spotted, tip tapering and cuneate, acute, base gradually narrowed from the middle, margins entire or slightly sinuate; **Inf** few-flowered corymbose panicles 10 - 15 cm; peduncle to 30 cm; **Ped** 6 - 25 mm; **Fl** pendent; **Cal** tubular, green or yellow, edged with red, sometimes hairy-glandular, tube 10 - 15 mm, lobes ovate-deltoid, acute, 4 - 9 × 6 - 8 mm; **Cl** yellow, tube 30 - 36 mm, lobes ovate to oblong, very obtuse and cuspidate, spreading, 9 - 12 × 5 - 6 mm; **St** inserted below the middle of the **Cl** tube, exserted; **Anth** ovate, 1.5 - 2.5 mm; **NSc** ± square, 1 - 2 mm; **Ca** 8 - 13 mm; **Sty** 25 - 28 mm; **Se** ovate, ± 0.7 mm.

K. suarezensis H. Perrier (Arch. Bot. Bull. Mens. 2(2): 21-23, 1928). **T:** Madagascar (*Perrier* 17882 [P, TAN]). – **D:** N Madagascar; limestone rocks.

≡ *Bryophyllum suarezense* (H. Perrier) A. Berger (1930) ≡ *Kalanchoe poincarei* var. *suaresensis* (H. Perrier) Boiteau ex Allorge-Boiteau (1995).

[2] Perennials or biennials; stems terete, stout, 20 - 25 mm Ø, 40 - 60 cm tall; **L** crowded, petiolate, thick, grey-green, glaucous, recurved, petiole thick, 6 - 7 mm Ø, broadly grooved in the upper part, thickened to the base, 1 - 5 cm, lamina lanceolate, 12 - 15 × 5 - 10 cm, tip attenuate, base attenuate to truncate, margins coarsely and irregularly dentate, with bulbils near the **L** tip; **Inf** many-flowered, paniculiform to corymbiform; **Ped** slender, 15 - 20 mm; **Fl** pendent; **Cal** red to reddish-violet, tube cylindrical, rounded at the base, 12 - 16 mm, lobes acute, spreading or recurved, 8 - 10 mm; **Cl** rose to yellow, tube globose, ± 4-angled, 23 - 26 mm, lobes recurved, very acute, sparsely glandular-hairy, 10 - 12 × ± 3 mm; **St** inserted below the middle of the **Cl** tube, included; **Anth** black, sagittate at the base, 1 - 1.5 mm; **NSc** square, tip cordate, ± 2 × 1.5 mm; **Ca** oblong, 8 - 10 mm; **Sty** 15 - 25 mm; **Se** cylindrical, 0.3 - 1 mm.

Close to *K. gastonis-bonniieri*.

K. subrosulata Thulin (Nordic J. Bot. 13: 51-52, fig. 1, 1993). **T:** Somalia, Bay Region (Thulin & al. 7756 [UPS, K, MOG]). – **D:** SW Somalia, NE Kenya; bushland in shallow red soil, usually over limestone, 350 - 1020 m. **I:** Thulin (1993: 92, fig. 47).

Incl. *Kalanchoe tayloris* Hamet (1958) (*nom. inval.*, Art. 32.1c).

[1] Perennials, entirely glabrous, to 65 cm tall, yellowish-green, with tuberous **R**stock; stems erect, slender, terete, to 4 mm Ø at the base; **L** sessile or shortly petiolate, ± crowded in a **Ros**, petiole to 7 mm, grooved above, lamina narrowly to very broadly elliptic or oblanceolate to broadly obovate, to 10.5 × 4 cm, membranous, tip obtuse to subacute, base cuneate, margin ± entire; **Inf** lax few-flowered corymbose cymes, 3 - 12 cm; **Ped** 2 - 5 mm; **Fl** erect; **Cal** tube 0.5 - 0.8 mm, lobes ± narrowly triangular, 1.5 - 3 × 1 - 1.2 mm; **Cl** yellow, tube cylindrical, widened at the base, 8 - 10 mm, lobes elliptic to obovate, obtuse to subacute, ± 4 × 2.8 mm, spreading; **St** inserted above the middle of the **Cl** tube, all included; **Anth** oblong, 0.5 - 0.6 mm; **NSc** linear, 1.5 - 2.3 mm; **Ca** lanceolate in sideview, 4 - 5 mm; **Sty** ± 1.2 mm; **Se** elongate, ± 0.8 mm.

Closely related to *K. densiflora*.

K. synsepala Baker (J. Bot. 11: 110, 1882). **T:** Madagascar (Baron 248 [K, P]). – **D:** C and C-S Madagascar; rocky sunny places. **I:** Hamet & Marnier-Lapostolle (1964: figs. 13-17). Boiteau & Al-lorge-Boiteau (1995: 179); Rauh (1995a: figs. 532-536). **Fig. XXI.g**

Incl. *Kalanchoe synsepala* var. *dissecta* hort. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Kalanchoe trichantha* Baker (1883); **incl.** *Kalanchoe brachycalyx* Baker (1887) (*nom. illeg.*, Art. 53.1); **incl.** *Kalanchoe gentyi* Hamet & H. Perrier (1914).

[1] Perennials, stoloniferous; stems woody, always simple, very stout, usually short, sometimes to 40 cm, erect or decumbent; **L** few in terminal **Ros**, sessile to subsessile, fleshy, very thick, tough, glabrous or short-hairy, ovate-spatulate, oblong with very obtuse tip or ± orbicular with rounded tip, 6 - 15 × 4 - 7 cm, base narrowed and amplexicaul, margins entire or undulate-dentate with rigid teeth, sometimes dissected; **Inf** axillary, usually 2 opposite very dense corymbose cymes, 2 - 9 cm; peduncle hairy-glandular in the upper part, 15 - 30 cm; **Ped** 3 - 12 mm; **Fl** erect; **Cal** campanulate, greenish, hairy-glandular, tube 2.5 - 4 mm, lobes deltoid, acute-cuspidate, 1 - 2 × 1.7 - 2.3 mm; **Cl** white, pink to purple, pubescent, tube tubularly 4-angled, 7 - 12 mm, lobes ovate to obovate, acutely cuspidate, spreading, 5 - 7 × 3 - 4 mm; **St** inserted towards the top of the **Cl** tube, exserted; **Anth** ovate, ± 1.2 mm; **NSc** linear, emarginate, ± 2 mm; **Ca** oblong-lanceolate in sideview, 8 - 10 mm; **Sty** 1.5 - 2 mm; **Se** oblong, ± 1 mm.

This is a very distinctive species, easily cultivated and propagated, and the only stoloniferous taxon

of the genus. The stolons produce themselves further stolons, and natural populations consist of a tangle of stolons and rosettes of various ages and sizes. The leaf size and colour are variable, which results in a number of selected cultivars.

K. tashiroi Yamamoto (Suppl. Icon. Pl. Formos. 2: 25, fig. 15, 1926). **T:** Taiwan, Kotosho Island (*Tashiro* s.n. [TNS ?]). – **D:** SE Taiwan.

[1] Perennials, entirely glabrous, robust; **L** petiolate, thick, fleshy, green above, pale below, petiole ± 2 mm, slightly grooved above, lamina deltoid or broadly ovate, 5.5 - 11.5 × 2.5 - 6.5 cm, tip broadly triangular, base truncate or broadly cuneate, margins irregularly crenate; **Inf** cymose panicles; **Ped** ± 1 mm; **Fl** erect; **Cal** green, tube short, lobes linear-lanceolate, ± 8 × 3 mm; **Cl** yellow, tube urceolate, ± 10 mm, widened to 6 mm at the base, lobes broadly elliptic, cuspidate, ± 7 × 5 mm; **St** inserted at the top of the **Cl** tube, included; **Anth** ± 1.5 mm; **NSc** linear, ± 4 × 0.5 mm; **Ca** incl. **Sty** 12 mm; **Se** oblong, ± 0.8 mm.

Close to *K. spathulata*.

K. teixeirae Hamet ex R. Fernandes (Bol. Soc. Brot., sér. 2, 53: 419-420, 1980). **T:** Angola (*Gosseweiler* 12489 [BM]). – **D:** Angola (Benguela); among granite boulders, ± 2500 m. **I:** Hamet (1931-1963: tt. 47-50, 1958).

[1] Perennial herbs to 60 cm tall, entirely glabrous, with tuberous **R**; stems simple, erect, robust, to 12 mm Ø at the base; **L** sessile, linear to oblong-linear, size not recorded, tip obtuse, base enlarged and amplexicaul, margins entire, upper face canaliculate in the lower part towards the base; **Inf** dense, corymbiform, to 4 cm; **Ped** 4 - 7 mm; **Fl** erect; **Cal** tube 1 - 1.5 mm, lobes lanceolate, acute, 5 - 6 × ± 1.6 mm; **Cl** yellow, tube almost cylindrical, rounded at the base, spotted with dark red, 9 - 10 mm, lobes ovate to suborbicular, subacute to rounded, apiculate, ± 2.5 × 1.5 - 2 mm; **St** inserted near the top of the **Cl** tube, upper **St** slightly exserted; **Anth** ± 0.8 mm, with a little globule at the tip; **NSc** linear, obtuse to emarginate, ± 3 × 0.5 - 0.7 mm; **Ca** narrowly oblong, 9 - 11 mm; **Sty** very short, ± 0.4 mm.

Insufficiently known species close to *K. brachyloba* and *K. lindmanii*.

K. tetramera Geddes (BMI 1928: 67, 1928). **T:** Thailand (*Kerr* 9988 [not located]). – **D:** Thailand; limestone rocks, 400 m.

[1] Erect, perennial (?); stems terete, fleshy, pubescent when young with dense indumentum, becoming glabrous; **L** entire, not further known; **Inf** broadly corymbose, densely hairy; peduncle pubescent; **Ped** pubescent, 5 - 6 mm; **Fl** yellow, sparsely finely pubescent, erect; **Cal** lobes lanceolate, acute, ± 7 × 2.5 mm; **Cl** yellow, tube urceolate, finely pubescent, ± 13 mm, lobes obovate, acute, ± 10 × 5 mm; **St** inserted near the top of **Cl** tube, included;

Anth oblong, ± 1.3 mm; **NSc** linear-lanceolate, ± 2 mm; **Ca** 8 - 9 mm; **Sty** ± 1.4 mm.

Very ill-known species, apparently close to *K. dixoniana* and *K. craibii*.

K. tetraphylla H. Perrier (Bull. Mus. Nation. Hist. Nat. 29: 452-453, 1923). **T**: Madagascar, Centre (Perrier 13178 [P]). – **D**: C-S Madagascar; rocky places, 1000 - 2000 m. **I**: Rauh (1983: 208); Rauh (1995a: figs. 538-542). **Fig. XXII.c**

[1] Perennials; stems always simple, woody and stout, to 3 cm $\varnothing$, short or to 1.5 m tall; **L** in **Ros** crowning the stem tips, generally in 2 pairs, to 1 cm thick, tough, densely glandular-hairy when young, later glabrous, sessile or with a short and very broad petiole, lamina ovate-orbicular, 13 - 15 cm long and wide, reddish or green (in cultivation), tip rounded, base truncate, margins coarsely dentate; **Inf** axillary, usually 2 opposite dense corymbose cymes, glandular-hairy; peduncle 8 - 15 cm; **Ped** glandular; **Fl** erect or spreading, entirely clothed with glandular white **Ha**; **Cal** green to reddish, tube 6 - 10 mm, lobes deltoid, acute, 6 - 8 mm; **Cl** white-yellow to yellow-green streaked with purple, tube ± 10 mm, lobes ovate, tip rounded or acuminate, ± 10 mm; **St** inserted just above the middle of the **Cl** tube, exerted; **Anth** rounded; **NSc** square, deeply emarginate and bidentate, ± 1 mm; **Ca** oblong, 6 - 8 mm; **Sty** 2.5 - 4 mm.

A very rare species, closely related to *K. synsepala*. They form a small group distinct from all other species of the genus by their habit, their growth form and additional characters.

K. thyrsiflora Harvey (FC 2: 380, 1862). **T**: RSA (Ecklon & Zeyher 1953 [S]). – **D**: SE Botswana, RSA; rocky ground in open bushland. **I**: Berger (1930: 407, fig. H-L); Tölken (1985: 70, fig. 9:1). **Fig. XXII.d**

[1] Biennials, completely glabrous, $\pm$ pulverulent with white sticky powder, 0.75 - 1.5 m tall; stems simple, erect, terete, stout; **L** sessile, thick, fleshy, more densely arranged towards the base, obovate, oblanceolate-oblong to spatulate, grey-green, margins $\pm$ tinged red, 6 - 17 $\times$ 2.5 - 12 cm, tip rounded or obtuse, base connate and semi-amplexicaul, slightly decurrent, margins entire; **Inf** dense many-flowered thyrses to 30 cm; **Ped** 6.5 - 12 mm, rather thick; **Fl** erect, with a penetrating sweet scent; **Cal** tube 1 - 1.5 mm, lobes ovate to oblong-lanceolate, acute, 3 - 7 $\times$ 2 - 2.7 mm; **Cl** golden-yellow, yellow or grey-green with a thick bloom, tube suburceolate or ovoid-oblong, 4-angled upwards, 12 - 20 mm, lobes ovate to subcircular, tip rounded or obtuse, 2 - 5 $\times$ 3 - 4.5 mm; **St** inserted at the top of the **Cl** tube, upper **St** exerted; **Anth** ovate-circular, 1.5 - 2 mm; **NSc** broadly oblong to rectangular, truncate-emarginate, 1.7 - 3 $\times$ 1 - 2 mm; **Ca** oblong-lanceolate in lateral view, 12 - 15 mm; **Sty** 1.5 - 3 mm; **Se** 1 - 1.3 mm.

K. tomentosa Baker (J. Bot. 11: 110, 1882). **T**: Madagascar (Baron 247 [K, P]). – **D**: C and C-S Madagascar; rocky places. **I**: Boiteau & Allorge-Boiteau (1995: 165); Rauh (1995a: figs. 223, 609-617). **Fig. XXI.h**

[1] Perennials, 80 - 100 cm tall, entirely and densely tomentose, clothed with whitish, reddish or $\pm$ brownish stellate **Ha**; stems erect, basally woody, branching from the base, densely leafy; **L** alternate, often arranged in **Ros**, sessile, very thick, fleshy, obovate, ovate to oblong or subcylindrical, upper face grooved-concave, lower face keel-like convex, 2 - 8 $\times$ 1.5 - 2.5 cm, tip obtuse, base attenuate, margins entire, rounded, coarsely serrate in upper part with dark brown teeth; **Inf** paniculate or corymbiform, 2 - 15 cm wide; peduncle 40 - 80 cm; **Ped** 4 - 10 mm; **Fl** erect to spreading, green, yellow-brown to purple, densely tomentose and with short simple glandular **Ha**; **Cal** tube 0.4 - 0.8 mm, lobes deltoid to linear, obtuse, 3 - 5 $\times$ 2 - 3 mm; **Cl** campanulate to urceolate, tube 10 - 12 mm, lobes deltoid to orbicular, erect, 2.5 - 3.5 $\times$ 4 - 5.5 mm; **St** inserted just below or at the middle of the **Cl** tube, included; **Anth** ovate, ± 1 mm; **NSc** $\pm$ rectangular, 0.8 - 1.2 mm; **Ca** 7 - 10 mm; **Sty** 1.5 - 2.5 mm; **Se** obovate, ± 2 mm.

A very attractive species, commonly cultivated in collections. In nature, the leaves present a pronounced variation in the form, size and colour of the hairs. Numerous horticultural forms and cultivars have been selected. In Madagascar, it is popular belief that a flowering plant of this taxon is an indication of richness and prosperity for the household.

K. tuberosa H. Perrier (Arch. Bot. Bull. Mens. 2(2): 24, 1928). **T** [syn]: Madagascar (Perrier 16135 [P]). – **D**: N Madagascar; 1000 - 2400 m.

[1] Perennials, entirely covered with a mealy-white bloom; **Rstock** woody-tuberos; stems annual, simple, slender, terete, erect to procumbent, 20 - 30 cm; **L** petiolate, whitish-pruinose, numerous, densely arranged in the upper stem parts, petiole 2 - 3 mm, lamina ovate, 2.5 - 3 $\times$ 1.5 - 1.9 cm, tip acute, base rounded, margins sinuate-dentate; **Inf** subsessile dense 2- to 25-flowered corymbose cymes; **Ped** 5 - 7 mm, whitish-pruinose; **Fl** erect; **Cal** tube ± 1 mm, lobes oblong, obtuse, 10 - 11 $\pm$ 4 mm; **Cl** beautifully pink to clear red, tube cylindrical, ± 40 mm, lobes ovate, acute, spreading, $\pm 15 \times 10$ mm; **St** inserted above the middle of the **Cl** tube, included; **Anth** oblong, ± 2.5 mm; **NSc** linear, entire to bifurcate, ± 5 mm; **Ca** 6 - 8 mm; **Sty** ± 20 mm.

A very ill-known and rare species. It could be of interest for cultivation due to the flowers and its probable frost-hardiness.

K. uniflora (Stapf) Hamet (Bull. Soc. Bot. France 57: 52, 1910). **T**: [icono]: Curtis's Bot. Mag. 135: t.

8286, 1909. – **D**: NW and N Madagascar; forests and ericoid vegetation, 1000 - 2000 m. **I**: Berger (1930; fig. 197E-F); Rauh (1995a: figs. 423-425). **Fig. XXII.a**

≡ *Kitchingia uniflora* Stapf (1908) ≡ *Bryophyllum uniflorum* (Stapf) A. Berger (1930); **incl.** *Kalanchoe ambrensis* H. Perrier (1928) ≡ *Bryophyllum ambrense* (H. Perrier) A. Berger (1930); **incl.** *Kalanchoe uniflora* var. *brachycalyx* Boiteau & Mannoni (1949); **incl.** *Kalanchoe uniflora* var. *typica* Boiteau & Mannoni (1949) (*nom. inval.*, Art. 24.3).

[2] Perennial epiphytic herbs; stems slender, glabrous, green, prostrate or climbing, rooting at the nodes; **L** subsessile to petiolate, very thick, fleshy, glabrous, bright green, petiole slender, 1 - 2.5 mm, lamina obovate, orbicular, orbicular-oblong to oblong, 0.4 - 3.5 × 0.4 - 1.5 cm, tip obtuse to rounded, base truncate to cuneate, margins crenulate, broadly 2- to 4-dentate in their upper part, sometimes almost trilobate; **Inf** 1- to 3-flowered cymes; peduncle 5 - 15 mm, brown, hairy; **Ped** filiform, thinly pubescent, purple, 5 - 15 mm; **Fl** pendent; **Cal** green, sparsely glandular-pilose, tube 0.5 - 1.5 mm, lobes ovate, subacute, cuspidate, 2 - 4 mm; **Cl** urceolate-tubular to urceolate, finely glandular-pilose to glabrous, tube bright red to red-violet, 11 - 19 mm, lobes ovate, obtusely cuspidate, 3.5 - 4.5 × 3 - 6 mm; **St** inserted below the middle of the **Cl** tube, included; **Anth** ovate, 1.2 - 1.4 mm; **NSc** linear to oblong-linear, emarginate, 1 - 1.6 × ± 0.6 mm; **Ca** 6 - 11 mm; **Sty** 6.5 - 12 mm; **Se** oblong, ± 0.6 mm.

This species is rarely one-flowered, despite its name. It is very beautiful and ornamental and is best cultivated in hanging baskets. In the vegetative state it resembles the epiphytic *Peperomia rotundifolia*.

K. usambarensis Engler & Hamet (Notizbl. Königl. Bot. Gart. Berlin 5: 302, 1913). **T** [neo]: Tanzania, Lushoto Distr. (*Bogner* s.n. [B]). – **D**: NE Tanzania; rocky hillsides, 1700 - 1800 m.

[1] Perennials, to 1.2 m tall; stems erect or decumbent at the base and rooting at the lower nodes, glabrous; **L** sessile, glabrous, obovate or oblong, green, to 10 × 5 cm, tip obtuse, base cuneate and semi-amplexicaul, margins entire or slightly sinuate; **Inf** ± globose, 15 - 25 cm, glandular-pubescent with short-stalked glandular **Ha**; **Ped** 2 - 5 mm; **Fl** erect; **Cal** tube 0.7 - 1 mm, lobes lanceolate, 3 - 4 × 1 - 2 mm; **Cl** bright red, lower part green, tube 9 - 12 mm, lobes oblong-ovate, obtuse or obtusely apiculate, 3.5 - 5 × 1.5 - 2.5 mm; **St** included; **Anth** oblong, ± 0.7 mm; **NSc** linear, ± 2 mm; **Ca** linear-lanceolate in sideview, 5.5 - 7.5 mm; **Sty** ± 1.5 mm.

K. ×vadensis Boom & Zeilinga (Succulenta 43(9): 124, 1964).

= *K. blossfeldiana* × *K. grandiflora*. This hybrid is an artificially obtained amphidiploid and is self-fertile and true-breeding.

K. velutina Welwitsch ex Britten (FTA 2: 396, 1871). **T**: Angola (*Welwitsch* 2490 [LISU]). – **D**: Angola, Zimbabwe.

[1] Perennials, to 1 m tall, entirely clothed with dense hispidulous to 0.5 mm long whitish or ferruginous **Ha**, rarely glabrous; stems erect, terete to subquadrangular and dark brown below, subterete and reddish-brown to ferruginous above; **L** petiolate, thick, fleshy, erect to spreading, petiole to 1 - 3 cm, lamina variable in shape, linear, lanceolate, oblong, spatulate to suborbicular, 1.5 - 11 × 0.7 - 3.5 cm, tip obtuse to rounded, base attenuate, margins entire or irregularly crenate-serrate; **Inf** corymbiform cymes, 8.5 - 10 × 6 - 15 cm; **Ped** 4.5 - 10 mm; **Fl** erect, yellow, orange-yellow to reddish-brown, densely hispid; **Cal** fleshy, tube 1.7 - 3 mm, lobes triangular, acutely cuspidate, 1 - 2.5 × ± 1.5 mm wide; **Cl** swollen-rounded at the base, thence 4-angled and attenuate, tube 11 - 20 mm, lobes ovate to obovate or rounded, obtusely cuspidate, 3 - 7.5 × 1.8 - 5.5 mm; **St** inserted in the upper part of the **Cl** tube, upper **St** exserted; **Anth** ovate-oblong, 0.5 - 0.7 mm; **NSc** linear-oblong, 1.7 - 2 × 0.5 - 0.7 mm; **Ca** ovate-oblong, 6.5 - 9 mm, very attenuate; **Sty** 2 - 4 mm; **Se** obovate, very obtuse, ± 0.7 mm.

In its pubescent forms close to *K. citrina*.

K. velutina ssp. *chimanimanensis* (R. Fernandes) R. Fernandes (Bol. Soc. Brot., sér. 2, 53: 430-431, 1980). **T**: Zimbabwe (*Leach* 9050 [K]). – **D**: Zimbabwe; among rocks on mountain slopes, 1700 - 1800 m.

≡ *Kalanchoe chimanimanensis* R. Fernandes (1978).

[1] **L** petiolate, petiole to 13 mm, lamina obovate, spatulate to suborbicular, 1.5 - 4.5 × 0.7 - 2 cm; **Ped** to 6.5 mm; **Cl** short, tube to 12.5 mm, ferruginous when dry, lobes to 4 × 2.5 mm, erect.

K. velutina ssp. *dangeardii* (Hamet) R. Fernandes (Bol. Soc. Brot., sér. 2, 53: 431-434, 1980). **T**: Angola (*Gossweiler* 4477 [BM]). – **D**: Angola (Cuanza Sul, Benguela); granitic hills, 850 - 1100 m.

≡ *Kalanchoe dangeardii* Hamet (1916).

[1] Plants tomentose or entirely glabrous; **L** sessile, linear to narrowly lanceolate, 3 - 11 × 1 - 3.5 cm; **Cl** long, tube 14 - 20.5 mm, whitish to yellowish when dry, lobes 6 - 7.5 × 3.5 - 5.5 mm, spreading.

K. velutina ssp. *velutina* – **D**: Angola (Cuanza Norte); woody savannas, 1150 - 1200 m.

Incl. *Kalanchoe exellii* Hamet (1963).

[1] **L** sessile or subsessile, elliptic-oblong to oblong-obovate, 5 - 9 × 2 - 2.3 cm; **Ped** to 10 mm; **Cl** short, tube to 12.5 mm, ferruginous when dry, lobes to 4 × 2.5 mm, erect.

K. viguieri Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 2: 187-189, 1914).

T: Madagascar (*Perrier* 11818 [P]). – **D:** SW Madagascar (Mahafaly Plateau); xerophytic bush on limestone. **I:** Hamet & Marnier-Lapostolle (1964: figs. 32-33); Boiteau & Allorge-Boiteau (1995: pl. 4: 6). **Fig. XXII.e**

Incl. *Kalanchoe viguieri* var. *latisejala* Hamet & H. Perrier (1914); **incl.** *Kalanchoe viguieri* var. *genuina* Hamet & H. Perrier (1914) (*nom. inval.*, Art. 24.3).

[2/1] Perennials to 1 - 2 m tall; stems simple or few-branched, erect, young covered with a felt of whitish stellate **Ha**, quickly glabrous, smooth, waxy, reddish, older stems with resinous bark; **L** petiolate, thick, fleshy, young felted like the stems, petiole 3 - 12 mm, lamina ovate to orbicular, 1.5 - 4.5 × 0.5 - 3.5 cm, tip obtuse, base rounded, margins entire or almost so; **Inf** few-flowered racemose panicles, bowed, 4 - 9 × 2 - 8 cm; peduncle pubescent; **Ped** 8 - 13 mm; **Fl** pendent, entirely felted with stellate **Ha**; **Cal** green to orange, tube 1 - 3 mm, lobes ovate to deltoid, 5 - 8 × 5 - 6.8 mm; **Cl** campanulate, pink to orange, tube 15 - 25 mm, lobes deltoid to oblong, cuspidate, 6 - 8 mm long and wide; **St** inserted below the middle of the **Cl** tube, slightly exerted; **Anth** ovate, 1.7 - 1.9 mm; **NSc** rounded, 0.9 - 1.2 × 1.5 - 2 mm; **Ca** ovate, 8 - 11 mm; **Sty** 10 - 16 mm.

All previous authors place this taxon erroneously in Sect. *Kalanchoe*. Even if it shows the typical calyx of that section, all other important characters are those of Sect. *Bryophyllum*. While somewhat intermediate between the 2 sections, the species is certainly closer to Sect. *Bryophyllum*. Apart from this, it is comparable to a group of very xeromorphic, strongly hairy taxa of Sect. *Kalanchoe* from S Madagascar.

K. waldheimii Hamet & H. Perrier (Ann. Inst. Bot.-Géol. Colon. Marseille, sér. 3, 3: 71-74, 1915). **T:** Madagascar (*Perrier* F228-1921 [P]). – **D:** C Madagascar (Antsirabé Distr.); granite or quartzite rocks, 1200 m. **I:** Boiteau & Allorge-Boiteau (1995: 107); Rauh (1995a: fig. 543).

≡ *Bryophyllum waldheimii* (Hamet & H. Perrier) Lauzac-Marchal (1974).

[2] Perennials, entirely glabrous, to 40 cm tall, forming tufts when old; stems numerous, erect or somewhat creeping, simple, basally branched, red-purple; **L** subsessile, thick, flat, fleshy, green-bluish with a few red spots, lamina obovate, 4 - 11 × 2 - 4.5 cm, tip obtuse to rounded, base narrowed to the winged very short petiole, sometimes with small auricles, margins purple-red, roundish crenate in the upper 1/3, with bulbils; **Inf** laxly corymbiform, with bulbils; **Ped** slender, 6 - 17 mm; **Fl** pendent; **Cal** yellow-green, lined with red-purple, tube 14 - 16 mm, lobes deltoid, acute, 5 - 6 × ± 3.5 mm; **Cl** pink to yellow-green with numerous red-purple lines, tube cylindrical, 16 - 21 mm, lobes obovate, subacute, ± 11 × 5 mm; **St** inserted below the middle of

the **Cl** tube, included; **Anth** ± 1.5 mm; **NSc** semi-orbicular, obtuse, ± 0.7 × 0.8 - 1.2 mm; **Ca** ovoid-oblong, 7 - 8 mm; **Sty** 17 - 18 mm.

This species, not often found in cultivation, is close to the group formed by *K. fedtschenkoi*, *K. laxiflora* and *K. marnieriana*.

K. welwitschii Britten (FTA 2: 394, 1871). **T:** Angola, Luanda (*Welwitsch* 2492 [LISU]). – **D:** Angola (Luanda, Benguela, Huila); xerophytic thickets, rocky hills and sandy soils.

Incl. *Kalanchoe welwitschii* var. *gracilituba* Britten (1871).

[1/2] Perennial herbs, entirely glabrous and glaucous, 1 - 2 m tall; stems erect, terete, straight; **L** petiolate, petiole 1.5 - 7.5 cm, lamina ovate to lanceolate, 9 - 25 × 3.5 - 12 cm, tip obtuse or acute, base rounded, cuneate to attenuate, margins entire, crenate or coarsely dentate with the teeth purple-margined; **Inf** lax corymbose panicles, 8 - 30 cm; **Ped** to 22 mm; **Fl** erect; **Cal** tube 1 - 2 mm, lobes green, broadly lanceolate, rather long-acuminate, 5 - 9 × 1.3 - 3 mm; **Cl** pale yellow, bright sulphur to orange, base green, tube pyramidal, acutely 4-angled, 16 - 25 mm, lobes ovate, abruptly acuminate and aristate, 7 - 11 × 4 - 7 mm, much spreading; **St** 4+4, 4 inserted at the base of the **Cl** tube, 4 inserted a little below the throat of the **Cl**, upper **St** almost exerted; **NSc** entire, subacute, ± 7 mm; **Ca** to 16 mm; **Sty** 6 - 9 mm.

According to native healers, this species has special virtues and a supernatural influence, esp. concerning climatic conditions. Its local name (translated) is "rain cloud", and together with *Caladium* (*Araceae*), it is used in sorcery. The insertion of the stamens (4 at the base of the corolla tube as in Sect. *Bryophyllum*, 4 near the throat as in Sect. *Kalanchoe*) is notable.

K. wildii Hamet ex R. Fernandes (Bol. Soc. Brot., sér. 2, 52: 204-207, 1978). **T:** Zimbabwe (*Ball* 16 [SAM]). – **D:** Zimbabwe; rocks. **I:** Hamet (1931-1963: tt. 27-30, 1956).

[1] Biennials, 30 - 70 cm tall, completely glabrous but covered everywhere with a chalky-white powder; stems usually simple, stout, terete below, indistinctly 4-angled above; **L** more densely arranged towards the base, sessile, obovate to oblong-spatulate or subcircular, 2 - 10.5 × 1.7 - 4 cm, tip rounded, base amplexicaul and decurrent on the stem, margins entire; **Inf** ± dense spikes or panicles, 7 - 26 cm; **Ped** to 10 mm; **Fl** erect; **Cal** fleshy, tube 1 - 1.5 mm, lobes ovate to elliptic, obtuse to subacute, 4 - 5 × 3 - 3.5 mm; **Cl** orange-pink or yellow, tube urceolate, ± 4-angled, 7 - 11 mm, lobes oblong or subrectangular, tip rounded or truncate, 3 - 5.5 × 2.2 - 2.7 mm; **St** inserted near the throat of the **Cl** tube, exerted; **Anth** suborbicular, ± 1 mm; **NSc** subrectangular, entire, ± 1.5 × 2.6 mm; **Ca** ± 7.5 mm; **Sty** 0.5 mm to almost absent.

K. yemensis (Deflers) Schweinfurth (Bull. Herb. Boissier 4(Appendix 2): 203, 1896). **T** [syn]: Yemen (*Deflers* 632 [P]). – **D**: N Yemen; rocky slopes, volcanic cones, wadi banks, field margins, 1900 - 2600 m. **I**: Raadts (1995: 258, fig. 4); Miller & Cope (1996: 471, fig. 90C).

≡ *Kalanchoe brachycalyx* var. *yemensis* Deflers (1889).

[1] Perennials, robust, 0.5 - 1 m tall, glabrous below, glandular-hairy above with up to 0.2 mm long **Ha**; stems terete, glabrous, branched from the base; **L** sessile, glabrous, narrowly oblong to lanceolate or ovate, 4 - 18 × 1.5 - 6 cm, tip obtuse to acute, base amplexicaul, margins entire to sinuate or rarely bluntly serrate; **Inf** corymbiform, 5 - 8 cm, glandular-hairy; **Ped** 1 - 5 mm; **Fl** erect; **Cal** sparsely glandular-pilose, tube 0.5 - 2 mm, lobes oblong-ovate to ovate-deltoid, acute, 4 - 9 × 1.5 - 4 mm; **Cl** bright yellow, pale yellow or orange-yellow, sparsely glandular-pilose, tube cylindrical, 8 - 13 mm, lobes ovate, mucronate, spreading, 5 - 10 × 2.5 - 8 mm; **St** inserted at the throat of the **Cl**, upper **St** slightly exserted; **Anth** ± 0.5 mm; **NSc** linear, 3.5 - 4.5 mm; **Ca** 8 - 10 mm; **Sty** 2 - 4 mm.

Very close to *K. lanceolata*.

K. yunnanensis Gagnepain (Notul. Syst. (Paris) 3: 220, 1916). **T**: China, Yunnan (*Tanant* s.n. [P?]). – **D**: China.

[1] Perennials (?), 40 - 60 cm tall; stems thickened at the base, glaucescent, glabrous; **L** petiolate, petiole slender, grooved above, amplexicaul at the base, ± 2 cm, lamina oblong to oblong-ovate, 7 - 10 × 2 - 4 cm, tip ovate, base obtuse, margins entire to slightly sinuate; **Inf** corymbose, 8 - 12 × ± 8 cm; **Ped** ± 5 mm; **Fl** erect, yellow, glabrous, 22 - 24 mm; **Cal** tube short, lobes deltoid-linear, reddish-brown; **Cl** ampulliform, tube widened towards the base, lobes ovate, acuminate; **St** inserted above the middle of the **Cl** tube; **Anth** ovate, subsagittate; **Ca** rather long-attenuate, ± 7 mm; **Sty** ± 3 mm.

An ill-known species, treated as synonym of *K. integra* by Fu & Ohba (2001).

×LENAPTOPETALUM

U. Eggli

×*Lenaptopetalum* G. D. Rowley (Nation. Cact. Succ. J. 37(3): 77, 1982).

Incl. ×*Lengraptophyllum* G. D. Rowley (1980) (*nom. inval.*, Art. H7.3).

= *Lenophyllum* × *Graptopetalum*. See Uhl (1993) for known hybrid combinations (none formally named).

LENOPHYLLUM

R. Moran

Lenophyllum Rose (Smithsonian Misc. Collect. 47: 159, 1904). **T**: *Sedum guttatum* Rose. – **Lit**: Moran (1994). **D**: USA (S Texas), NE Mexico. **Etym**: Gr. 'lenos', trough, tank, bath; and Gr. 'phyllon', leaf; for the often channelled leaves.

Perennial glabrous herbs; **R** fibrous or thickened; **L** decussate, in few basal pairs, smaller and more spaced above, thick, often channelled, elliptic to roundish or rhombic, tips acuminate to rounded; **Inf** terminal, either cymes of few several-flowered cincinni, or narrow thyrses of 10 - 35 few-flowered compact cincinni or reduced to a raceme or spike above or throughout; **Fl** subsessile, 5-merous, obdiplostemonous; **Sep** erect or ascending, nearly equal, lanceolate to oblanceolate, ± as long as the open **Cl**; **Pet** yellow or yellowish, free to the base, erect in the lower ½, upper ½ spreading to recurved, lanceolate to oblanceolate, 5 - 8 mm; **St** erect, slightly exserted, epipetalous **Fil** adnate for ± ½ their length; **NSc** subquadrate; **Ca** erect, narrow, tapering into slender **Sty**; **Fr** many-seeded follicles; **Se** brown, ellipsoid, longitudinally striate. – **Cytology**: **Cyto**logy: Probably x = 11 (Uhl 1996a).

Uhl (1996a) crossed 4 of the 7 species of *Lenophyllum* successfully with species of *Echeveria* (= × *Lenoveria*), *Graptopetalum* (= × *Lenaptopetalum*) and *Pachyphytum* (= × *Lenophytum*), thus placing it in the same comparium, but it seems less closely related to the other genera than they to each other. Whereas in other genera of the comparium polyploids generally are autopolyploid, here all species studied, though of unknown parentage, appeared to be allopolyploid.

The genus falls into 2 informal groups:

- [1] **Inf** spikes, racemes or narrow thyrses with 10 - 35 1- to 3-flowered cincinni; n = 22, 44.
- [2] **Inf** cymes or thyrses with 2 - 10 simple or bifurcate **Br**, cincinni 3- to 15-flowered; n = 32, 33, or unknown.

L. acutifolium Rose (Smithsonian Misc. Collect. 47: 162, fig. 19, 1904). **T**: Mexico, Nuevo León (*Pringle* s.n. in *Rose* 768 [US 396786, NY, UC]). – **D**: Mexico (Coahuila, Nuevo León, Tamaulipas), 650 - 1350 m. **I**: Moran (1994: 2, 6).

[1] Plants 10 - 40 cm tall, pale green to purplish or reddish; **L** elliptic-lanceolate, acute, 2 - 5 × 0.5 - 1.5 cm; **Inf** narrow thyrses or subspicate, 3 - 20 × 1 - 3 cm, with 10 - 25 cincinni with 1 - 3 **Fl**; **Sep** acute; **Cl** pale yellow, strongly marked with red on the outside. – **Cytology**: n = 22, 44.

L. guttatum (Rose) Rose (Smithsonian Misc. Collect. 47: 160, pl. 20, 1904). **T**: Mexico, Coahuila (*Palmer* 309 [US, NY, UC]). – **D**: Mexico (Coahuila, Nuevo León), 1200 - 2100 m. **I**: Moran (1994: 13-14). **Fig. XXII.f**

≡ *Sedum guttatum* Rose (1903).

[2] Plants 5 - 20 cm tall; **L** rhombic-ovate to -obovate or -lanceolate, low-rounded at the very tip, 2 - 4 × 2 cm, grey-green blotched with purplish-red; **Inf** cymes with few cincinni of 8 - 15 **Fl**; **Sep** rounded at tips; **Cl** yellow, outside with red lines. – *Cytology*: n = 32, 33.

L. latum Moran (CSJA 66(3): 126-128, ill., 1994). **T**: Mexico, Tamaulipas (Moran 13392 [SD 61028, BH, SD]). – **D**: Mexico (Nuevo León, Tamaulipas), 500 - 1800 (?) m. **Fig. XXII.b, XXII.g**

[1] Plants to 50 cm tall or reportedly to 2 m long, green or tinged purple-red; **L** elliptic-ovate, acute, 3 - 5.5 × 1.2 - 3.5 cm; **Inf** thyrses 3 - 25 × 1 - 3 cm with 10 - 35 cincinni or cymules with 1 - 4 **Fl**; **Sep** acute; **Cl** light or greenish-yellow. – *Cytology*: n = 22.

This taxon differs from *L. acutifolium* in its larger size and esp. its wider leaves, but their relationship needs more study.

L. obtusum Moran (Haseltonia 2: 17-18, ill., 1994). **T**: Mexico, Nuevo León (Uhl 1920 [SD 94815, BH, HNT, SD]). – **D**: Mexico (Nuevo León); 900 - 1220 m.

[2] Plants 10 - 20 cm tall, green or glaucous or becoming purplish; **L** broadly ovate to elliptic or rounded-obovate, broadly obtuse to rounded, 2 - 4 × 2 - 4 cm; **Inf** cymes with several cincinni with 4 - 10 **Fl**; **Sep** obtuse to rounded; **Cl** dull yellow with brownish tips. – *Cytology*: n = 32, 33.

More study is needed of the little-known *L. weinbergii* to see how this plant is related.

L. reflexum S. S. White (Bull. Torrey Bot. Club 68: 496-497, ill., 1941). **T**: Mexico, Tamaulipas (Bartlett s.n. [MICH]). – **D**: Mexico (Tamaulipas); ± 1200 m. **I**: Moran (1994: 10-12).

[2] Plants 15 - 30 cm tall, bright green becoming purplish; **L** ovate to elliptic, acute with narrowly acute tip, to 4.5 × 3 cm; **Inf** thyrses 5 - 6 × 2 - 4 cm with several cincinni with 3 - 8 **Fl**; **Sep** acute; **Cl** yellow or yellowish-green.

The type of this poorly known species is a much etiolated cultivated plant.

L. texanum (J. G. Smith) J. N. Rose (Smithsonian Misc. Collect. 47: 162, 1904). **T**: USA, Texas (Nealley s.n. [MO, US 48513]). – **D**: USA (S Texas), NE Mexico; below 100 m. **I**: Moran (1994: 8). **Fig. XXII.h**

≡ *Sedum texanum* J. G. Smith (1895) ≡ *Villadia texana* (J. G. Smith) Rose (1903); **incl.** *Lenophyllum pusillum* Rose (1905).

[1] Plants 10 - 40 cm tall, green becoming reddish; **L** ovate-lanceolate to elliptic to oblanceolate, acuminate, 1 - 2.5 × 0.4 - 1 cm; **Inf** racemes or spikes or narrow thyrses, 2 - 15 × 1.2 - 2 cm, with 5 - 25 commonly 1-flowered **Br**; **Sep** acute to acumi-

nate; **Cl** buffy or dull yellow, often marked with red. – *Cytology*: n = 44.

This taxon is most prolific as the leaves readily fall off and root. The vernacular name "Chisme" was noted with a specimen from Texas.

L. weinbergii Britton (Smithsonian Misc. Collect. 47: 160, fig. 18, 1904). **T**: Mexico, Coahuila (McDowell s.n. in Weinberg s.n. [NY, US 431408]). – **D**: Mexico (Coahuila); 1600 m. **I**: Moran (1994: 15-16).

[2] Plants to 10 cm tall, pale green or purplish; **L** rhombic-obovate, obtuse with incurved margins, 1.5 - 2.5 × 1 - 2.3 cm; **Inf** cymes of 2 - 6 **Br**, cincinni with 3 - 7 **Fl**; **Sep** obtuse to rounded; **Cl** yellow.

Insufficiently known; material cultivated under this name is often *L. obtusum*. Recently, plants with pale pinkish flowers have been seen in cultivation which might perhaps belong in the same relationship.

×LENOPHYTUM

U. Eggli

×**Lenophytum** C. H. Uhl (CSJA 65(6): 273, 1993). = *Lenophyllum* × *Pachyphytum*. Uhl (1993) only lists the combination *P. hookeri* × *L. reflexum*.

×LENOVERIA

U. Eggli

×**Lenoveria** C. H. Uhl (CSJA 65(6): 272, 1993). = *Lenophyllum* × *Echeveria*. See Uhl (1993) for the known hybrid combinations (none formally named).

METEROSTACHYS

H. Ohba

Meterostachys Nakai (Bot. Mag. (Tokyo) 49(578): 74, 210 [erratum], 1935). **T**: *Cotyledon sikokiana* Makino. – **Lit**: Moran (1972); Ohba (1978). **D**: Japan, Korea, China. **Etym**: Gr. 'stachys', spike; for the inflorescences. The first part of the name 'meteros' is probably a fantasy word, as the generic name would be an illegitimate homonym in the form originally published ('Merostachys', from Gr. 'meros', part, place).

Perennials with thickened tap**R** and small **Ros**; rosulate **L** linear to linear-triangular (esp. winter **L**), 7 - 25 × 2 - 3 mm, tip cuspidate to spinulose (often cartilaginous); flowering stems from the **Ax** of rosulate **L**, annual, simple, 1.5 - 8 cm tall, erect, axis mamillate, leafy, **L** alternate or ternate, sessile, linear-subulate or linear-lanceolate, 7 - 12 × 1.5 - 2.2 mm, tip spiny-acute; **Inf** terminal, cymose, brac-

teate, lax; **Fl** hermaphrodite, 5- (rarely 4-) merous; **Ped** often > **Fl** length; **Sep** linear-lanceolate, 1.7 - 2.6 mm, fleshy, persistent, basally connate; **Pet** basally connate for $\frac{1}{3}$ to $\frac{2}{3}$, white, often with reddish hue, broadly lanceolate to lanceolate, 2.5 - 4 mm, ascending; **St** obdiplostemonous, shorter than the **Pet**; **Anth** deep red; **NSc** oblong, whitish, $\pm$ 0.8 mm long; **Ca** $\pm$ 3 mm, ventrally not gibbose, basally not tapering, suberect; ovules 4 - 6; **Se** cylindrical. – *Cytology*: $n = 16$ (Uhl & Moran 1972).

When first published, the generic name was misspelled as 'Merostachys', but neither spelling results in a meaningful name. The relationship of this monotypic genus is not yet clear. Though Ohwi (1953: 585-586) included it in the synonymy of *Orostachys*, the two differ greatly. *Orostachys* is closely related to *Hylotelephium* in having stipitate or basally narrowed carpels, while *Meterostachys* differs in floral features.

M. sikokiana (Makino) Nakai (Bot. Mag. (Tokyo) 49(578): 74-75, ill., 1935). **T**: Japan, Tosa Prov. (Makino s.n. [MAK]). – **D**: W Japan, Korea (Quelpaert), China (Sichuan: Mt. Omei). **I**: Ohwa (1982b: t. 140-144); Lee & Lee (2000: 45, t. 3D).

$\equiv$ *Cotyledon sikokiana* Makino (1891) $\equiv$ *Sedum sikokianum* (Makino) Hamet (1929) (*nom. illeg.*, Art. 53.1) $\equiv$ *Orostachys sikokiana* (Makino) Ohwi (1953); **incl.** *Sedum leveilleianum* Hamet (1908); **incl.** *Sedum oriento-asiaticum* Makino (1927).

Description as for the genus.

The occurrence of this species in China has only recently been reported (Byalt 1997) and represents a considerable disjunction.

MONANTHES

R. Nyffeler

Monanthes Haworth (Saxifrag. Enum., 2: 68, 1821). **T**: *Sempervivum monanthes* Aiton [= *Monanthes polyphylla* Haworth. Typification by inference, only element included.]. – **Lit**: Nyffeler (1992); Nyffeler (1995). **D**: Canary Islands, Selvagens Islands. **Etym**: Gr. 'mono-', one-, single; and Gr. 'anthos', flower; referring to the few-flowered inflorescences (though only rarely 1-flowered).

Incl. *Petrophytes* Webb & Berthelot (1841) (*nom. illeg.*, Art. 52.1). **T**: *Sempervivum monanthes* Aiton.

Perennial or annual herbs or shrublets, glabrous or glandular-hairy, covered with bladder-cell idiospores; **R** fibrous; **L** alternate or decussate, in loose, compact or very dense **Ros**, or **Int** elongated, **L** simple, entire, succulent, ovate, elliptic or obovate, acute, rounded or truncate, glabrous or glandular-hairy, sometimes apically conspicuously papillose, variously variegated with red; **Inf** either terminal from the centres of the **Ros** or **Br** tips, or in the

form of lateral deciduous flowering shoots, reduced thyrses of 1 - 3 (-5) evenly or basally branched scorpioid cymes with (1-) 3 - 8 **Fl**; **Ped** filiform, glandular-hairy or glabrate, variously coloured ranging from pale green to violet-brown; **Fl** (5- to) 6- to 8- (to 9-) merous, 2 - 6 mm $\varnothing$, obdiplostemonous; **Sep** fleshy, basally slightly connate, ovate, acuminate, rarely acute, dorsally mostly glandular-hairy and papillose, green and variously blotched with red; **Pet** free, spreading or slightly recurved, narrowly oblong or oblong and occasionally widened in the upper part, acute or acuminate, partly mucronate, dorsally and occasionally laterally with glandular **Ha**, pale yellow and variously striped with red; **St** $2\times$ as many as **Pet**; **Fil** free, pale yellow to light red, episealous **Fil** erect, slightly shorter than the epipetalous **Fil**, the latter depressed by the **Nec**; **Anth** globose-cylindrical, latrorse, before dehiscence variously coloured from yellow-white to violet-brown; **NSc** conspicuously enlarged, generally somewhat bilobed or flabellate, apically retuse or orbiculate, erose, crenulate or denticulate, pale yellow to dark red; **Ca** as many as **Pet**, basally immersed in the **Rec**, often with some short scattered glandular **Ha**, papillose or smooth, yellow-green and variously blotched with red; **Fr** follicles erect, opening along the ventral suture, some transversally breaking off; **Se** almost smooth or distinctly papillate to costate.

The genus has recently been revised by Nyffeler (1992). The present treatment slightly differs insofar that *M. atlantica* is removed from *Monanthes* and treated as *Sedum surculosum*, and that *M. icterica* is placed in its own section. Recent molecular analyses by Mes & al. (1997) and Mort & al. (2002) indicate that *M. icterica* either represents the sister group of *Aichryson*, or is sister to a clade consisting of *Aeonium* and the perennial taxa of *Monanthes*. Here, *M. icterica* is retained in *Monanthes* awaiting further investigations.

The 9 species of *Monanthes* fall into 4 distinct groups:

- [1] Sect. *Monanthes*: Perennial, densely branched **Ros** plants or small shrublets; **Inf** terminal from the centres of the **Ros**; **Fl** 7- to 9-merous, 4 - 6 mm $\varnothing$; **Pet** narrowly oblong, with distinct glandular **Ha** along the margins; **NSc** flabellate, basally cuneate or attenuate.
- [2] Sect. *Sedoideae* Nyffeler 1992: Perennials, diffusely branched shrublets; **Inf** terminal from the **Br** tips; **Fl** 7- to 8-merous, 4 - 6 mm $\varnothing$; **Pet** oblong, glabrous along the margins; **NSc** $\pm$ bilobed, slightly to distinctly clawed.
- [3] Sect. *Petrophyllae* P. V. Heath 1994: Perennial, solitary or partly offsetting **Ros** plants; **Inf** in the form of lateral deciduous flowering shoots; **Fl** 5- to 7-merous, 2 - 4 mm $\varnothing$; **Pet** narrowly oblong to oblong, occasionally slightly widened apically, glabrous along the margins; **NSc** $\pm$ bilobed, distinctly clawed.

[4] Sect. *Annuae* Sventenius 1960: Annual herbs; **Inf** terminal from the **Br** tips; **Fl** 6- to 7-merous, 3 - 4 mm Ø; **Pet** oblong and slightly widened apically, glabrous along the margins; **NSc** ± bilobed, distinctly clawed.

Hybridization is a common phenomenon among taxa occurring sympatrically in nature. Numerous hybrid taxa have been described based on intermediate morphology. Artificial hybridization experiments revealed that all perennial taxa are interfertile (Nyffeler 1995). For a complete list of nothotaxa and hybrid formulae see Nyffeler (1992) and Heath (1994). Plants of hybrid origin are rather widely distributed in cultivation, and for the sake of completeness, the following list of published named nothospecies is given: *M. ×anagiflora*, *M. ×burchardii*, *M. ×chamorgensis*, *M. ×elizabethae*, *M. ×gomerensis*, *M. ×hybrida*, *M. ×intermedia*, *M. ×isabellae*, *M. ×polycaulis*, *M. ×pumila*, *M. ×silophylla*, *M. ×sventenii*, and *M. ×tilophila*.

The following names are of unresolved application but are referred to this genus: *Monanthes spatulata* Cree ex Steudel (1841); *Sempervivum micranthes* Webb ex Steudel (1841).

M. anagensis Praeger (Trans. & Proc. Bot. Soc. Edinburgh 29: 216, 1925). **T**: Canary Islands, Tenerife (*Bourgeau* s.n. [E]). – **D**: Canary Islands (Tenerife: Anaga Mountains); (100-) 600 - 900 m.

[2] Perennial slightly woody diffusely branched shrublets, 15 - 30 cm tall; **Br** ascending or erect, somewhat tortuous, slender, 3 - 5 mm Ø; **L** alternate, clustered near **Br** tips, 9 - 18 × 2 - 4 mm, 2 - 4 mm thick, narrowly elliptic, acuminate, with a central longitudinal furrow above, glabrous, smooth; **Inf** terminal, regularly branched; **Ped** 7 - 15 mm, glabrous or with few very short glandular **Ha** (≤ 0.05 mm); **Fl** 6- to 8-merous, 4 - 6 mm Ø; **Pet** 3.4 - 4.6 × 1.1 - 1.6 mm, oblong, acute or acuminate; **NSc** 1.4 - 1.6 × 1.6 - 2.2 mm, lamina ± bilobed, retuse or obcordate, crenulate, often only indistinctly clawed.

M. brachycaulos (Webb & Berthelot) Lowe (Fl. Salvag. Tent., 12, 1869). **T**: Canary Islands, Tenerife (Webb (?) s.n. [FI ?]). – **D**: Canary Islands (Gran Canaria, Tenerife); 20 - 2500 m.

≡ *Petrophytes brachycaulos* Webb & Berthelot (1841) ≡ *Sempervivum brachycaulos* (Webb & Berthelot) Kuntze (1891); **incl.** *Monanthes brachycaulon* hort. (s.a.); **incl.** *Petrophytes brachycaulos* var. *bulbosus* Knoche in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Petrophytes brachystachys* Webb in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sempervivum bulbosum* Solander ex Webb & Berthelot (1841) (*nom. inval.*, Art. 34.1); **incl.** *Petrophytes brachycaulos* var. *canariae* Pitard (1909); **incl.** *Petrophytes brachycaulos* var. *teneriffae* Pitard (1909); **incl.** *Monanthes brachycaulos* fa. *fasciata* Praeger (1929); **incl.** *Monanthes brachycaulos* fa. *ramosa*

(1929); **incl.** *Monanthes niphophila* Sventenius (1946) ≡ *Monanthes brachycaulos* fa. *niphophila* (Sventenius) P. V. Heath (1994); **incl.** *Monanthes brachycaulos* var. *adenopetala* Sventenius (1960); **incl.** *Monanthes brachycaulos* var. *nivata* Sventenius (1960) (*nom. inval.*, Art. 37.1); **incl.** *Monanthes praegeri* Bramwell (1969) ≡ *Monanthes brachycaulos* fa. *praegeri* (Bramwell) P. V. Heath (1994).

[3] Perennial, solitary or sometimes offsetting **Ros** plants; stems short and stout (± caudiciform) or slightly to distinctly elongate, 5 - 12 mm Ø; **Ros** loose or rather compact, flat, 7 - 35 mm Ø, with ≤ 60 **L**; **L** 5 - 18 × 3 - 6 mm, 1 - 2 mm thick, narrowly obovate, acute, attenuate into a narrow base, glabrous or with few very short glandular **Ha** (≤ 0.05 mm) near the base, slightly papillose above; **Inf** as lateral, simple or branched flowering shoots, evenly branched; **Ped** 4 - 10 mm, glandular-hairy (**Ha** ≤ 0.3 mm); **Fl** 6- to 7-merous, 3 - 4 mm Ø; **Pet** 2.3 - 3.7 × 0.5 - 0.7, oblong and occasionally somewhat widened in the upper part, acute or mucronate; **NSc** 1.1 - 1.6 × 1.6 - 1.9 mm, lamina somewhat bilobed, retuse or obcordate, erose, distinctly clawed.

M. icterica (Webb ex Bolle) Christ (BJS 9: 162, 1888). **T** [lecto]: Canary Islands, Gomera (*Bourgeau* 158 [BM, E, G]). – **D**: Canary Islands (W Tenerife, E Gomera); 100 - 900 m. **Fig. XXIII.a, XXIII.b**

≡ *Petrophytes icterica* Webb ex Bolle (1859); **incl.** *Aichryson mollis* Pitard (1909).

[4] Dwarf glabrous simple or ± horizontally branched annual herbs, 2 - 6 cm tall; **L** alternate, ± clustered near the **Br** tips, 5 - 9 × 2 - 4 mm, elliptic or obovate, rounded, glabrous and slightly papillose; **Inf** terminal, evenly branched; **Ped** 2 - 5 mm, glandular-hairy (**Ha** ≤ 0.3 mm); **Fl** 6- to 7-merous, 3 - 4 mm Ø; **Pet** 1.9 - 2.6 × 0.6 - 0.9 mm, oblong and occasionally somewhat widened above, acute or mucronate; **NSc** 0.9 - 1.4 × 1.1 - 1.6 mm, lamina bilobed, retuse, erose, distinctly clawed.

M. laxiflora (De Candolle) Bolle ex Bornmüller (RSN 3: 26, 1906). **T**: Canary Islands, Tenerife (*Courant* s.n. [G-DC]). – **D**: Canary Islands (Lanzarote, Fuerteventura, Gran Canaria, Tenerife, Gomera); 50 - 1100 m. **Fig. XXIII.c**

≡ *Sedum laxiflorum* De Candolle (1828); **incl.** *Monanthes anagensis* var. *laxiflora* hort. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Petrophytes agriostaphis* var. *minor* Burchard in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Petrophytes agriostaphis* Webb & Berthelot (1841) ≡ *Monanthes agriostaphis* (Webb & Berthelot) Christ (1888) ≡ *Sempervivum agriostaphis* (Webb & Berthelot) Kuntze (1891); **incl.** *Petrophytes microbotrys* Bolle & Webb (1859) ≡ *Monanthes microbotrys* (Bolle & Webb) Bolle (1892) ≡ *Monanthes laxiflora* var. *microbotrys* (Bolle & Webb) Burchard (1929) (*nom. inval.*, Art.

34.1); **incl.** *Monanthes chlorotica* Bornmüller (1906) $\equiv$ *Monanthes laxiflora* fa. *chlorotica* (Bornmüller) Praeger (1928) $\equiv$ *Monanthes laxiflora* var. *chlorotica* (Bornmüller) G. Kunkel (1980); **incl.** *Monanthes laxiflora* var. *eglandulosa* Bornmüller (1906); **incl.** *Monanthes laxiflora* var. *genuina* Bornmüller (1906) (*nom. inval.*, Art. 24.3); **incl.** *Monanthes laxiflora* fa. *minor* Praeger (1929); **incl.** *Monanthes laxiflora* fa. *foliis aureis* Praeger (1929) (*nom. inval.*, Art. 23.1, 24.2).

[2] Perennial slightly woody, diffusely to densely branched shrublets, 10 - 20 cm tall; **Br** decumbent or ascending, often later pendulous, somewhat tortuous, slender, 2 - 5 mm $\varnothing$; **L** decussate, occasionally $\pm$ clustered near the **Br** tips, 5 - 12 $\times$ 3 - 8 mm, 3 - 6 mm thick, obovate or elliptic, occasionally almost suborbicular, rounded or somewhat acute, mostly with a central longitudinal furrow above, glabrous, partly covered with whitish wax platelets; **Inf** terminal at the **Br** tips, regularly branched; **Ped** 4 - 12 mm, glabrous or glandular-hairy (**Ha** $\leq$ 0.2 mm); **Fl** 6- to 7-merous, 4 - 5 mm $\varnothing$; **Pet** 2.9 - 4.4 $\times$ 0.9 - 1.4 mm, oblong, acuminate; **NSc** 1.3 - 1.7 $\times$ 1.5 - 2.2 mm, lamina bilobed, retuse or obcordate, crenulate or rarely erose, distinctly clawed.

M. lowei (Paiva) P. Pérez & Acebes (Vieraea 14(1-2): 153-154, 1984). **T** [lecto]: Selvagem Grande (Paiva 166 [BM]). – **D**: Selvagens Islands. $\equiv$ *Sempervivum lowei* Paiva (1867).

[3] Perennial regularly offsetting **Ros** plants, offsets 1 - 5 cm, tightly appressed to the ground; stems short, stout and $\pm$ caudiciform, 4 - 7 mm $\varnothing$; **Ros** loose or rather compact, flat, 10 - 25 mm $\varnothing$ with 15 - 45 **L**; **L** 7 - 15 $\times$ 2 - 4 mm, $\pm$ 1 - 2 mm thick, obovate, rounded (younger **L** somewhat rhombic), distinctly attenuate into a petiole-like base, glabrous, slightly papillose; **Inf** from lateral simple or rarely branched flowering shoots, evenly branched; **Ped** 3 - 8 mm, sparsely glandular-hairy; **Fl** mostly 6-merous, 3 - 4 mm $\varnothing$; **Pet** 2.4 - 3.6 $\times$ 1.1 - 1.5 mm, oblong and occasionally somewhat widened in the upper part, acute; **NSc** 1 - 1.5 $\times$ 1.5 - 2 mm, lamina bilobed, obcordate, crenulate, distinctly clawed.

M. minima (Bolle) Christ (BJS 9: 162, 1888). **T**: Canary Islands, Tenerife (Bolle s.n. [B]). – **D**: Canary Islands (S and E Tenerife); 50 - 800 m. **Fig. XXIII.d**

$\equiv$ *Petrophytes minima* Bolle (1859); **incl.** *Monanthes dasyphylla* Sventenius (1946); **incl.** *Monanthes adenoscepes* Sventenius (1960); **incl.** *Monanthes wildpretii* Bañares & Scholz (1990).

[3] Perennial, solitary or rarely offsetting **Ros** plants; stems short, stout, $\pm$ caudiciform, 5 - 10 mm $\varnothing$; **Ros** dense, 5 - 10 mm tall, 10 - 35 mm $\varnothing$; **L** 6 - 15 $\times$ 1 - 3 mm, 1 - 2 mm thick, narrowly obovate, rounded or somewhat acuminate, attenuate into a long petiole-like base, densely glandular-pubescent (**Ha** $\leq$ 0.3 mm), viscid, slightly papillose; **Inf** from

lateral simple and glandular-pubescent flowering shoots, evenly branched; **Ped** 3 - 9 mm, glandular-hairy (**Ha** $\leq$ 0.4 mm); **Fl** 5- to 7-merous, 2 - 3 mm $\varnothing$; **Pet** 1.4 - 2.6 $\times$ 0.4 - 0.6 mm, narrowly oblong, acuminate; **NSc** 0.9 - 1.4 $\times$ 1.3 - 1.6 mm, lamina somewhat bilobed, obcordate, erose or denticulate, distinctly clawed.

M. muralis (Webb ex Bolle) Hooker fil. (CBM 28: t. 5988 + text, 1872). **T** [lecto]: Canary Islands, Hierro (*Perraudière* s.n. in *Bourgeau* 1284 [K, C, E, G, JE, MA, Z]). – **D**: Canary Islands (Hierro, La Palma); 300 - 800 m. **Fig. XXIII.e, XXIII.f**

$\equiv$ *Petrophytes muralis* Webb ex Bolle (1859) $\equiv$ *Sempervivum monanthes* var. *murale* (Webb ex Bolle) Kuntze (1891); **incl.** *Sempervivum monanthes* var. *subcrassicaule* Kuntze (1891) $\equiv$ *Petrophytes muralis* ssp. *subcrassicaulis* (Kuntze) Bornmüller (1903) $\equiv$ *Monanthes subcrassicaulis* (Kuntze) Praeger (1929).

[1] Small perennial, basally slightly woody, densely branched shrublets with rosulate **L**, 5 - 10 cm tall; **Br** ascending or decumbent, later often pendulous, tortuous, slender, 2 - 5 mm $\varnothing$; **Ros** compact, the innermost **L** soon patent, parastichies 2:3; **L** 6 - 10 $\times$ 3 - 4 mm, $\pm$ 2 mm thick, obovate, rounded or somewhat acute, generally with some glandular **Ha** in the lower part, apically conspicuously papillose, esp. along the margins; **Inf** terminal from the centres of the **Ros**, basally branched; **Ped** 5 - 15 mm, glandular-hairy (**Ha** $\leq$ 0.7 mm); **Fl** 6- to 7-merous, 3 - 5 mm $\varnothing$; **Pet** 2.9 - 4.1 $\times$ 0.5 - 0.7 mm, narrowly oblong, acuminate, generally with glandular **Ha** ($\leq$ 0.3 mm) along the margins; **NSc** 1.2 - 1.7 $\times$ 1.4 - 2.1 mm, lamina somewhat flabellate, retuse, denticulate, clawed or basally attenuate.

M. pallens (Webb) Christ (BJS 9: 162, 1888). **T** [lecto]: Canary Islands, Gomera (*Bourgeau* 270 [BM, G, JE, Z]). – **D**: Canary Islands (W Tenerife, Gomera); 50 - 1100 m. **Fig. XXIII.g**

$\equiv$ *Petrophytes pallens* Webb in Christ (1888); **incl.** *Petrophytes brachycaulos* var. *gomerae* Pitard (1909); **incl.** *Monanthes pallens* fa. *ramosa* Praeger (1929); **incl.** *Monanthes pallens* var. *silensis* Praeger (1929) $\equiv$ *Monanthes silensis* (Praeger) Sventenius (1969); **incl.** *Monanthes pallens* fa. *fasciata* Praeger (1932).

[3] Perennial, solitary or partly offsetting **Ros** plants; stems short or slightly elongate, stout and $\pm$ caudiciform, 3 - 7 mm $\varnothing$; **Ros** very dense, 7 - 15 mm tall, 10 - 40 mm $\varnothing$, generally with $>$ 100 **L**; **L** 5 - 18 $\times$ 1 - 3 mm, 1 - 2 mm thick, narrowly obovate, acute or subtruncate, attenuate into a long narrow base, glabrous or occasionally with some short glandular **Ha** ($\leq$ 0.1 mm), apically densely papillose; **Inf** from lateral simple flowering shoots, evenly branched; **Ped** 3 - 10 mm, glandular-hairy (**Ha** $\leq$ 0.4 mm); **Fl** 5- to 7-merous, 3 - 4 mm $\varnothing$; **Pet** 2.8 - 3.6 $\times$ 0.5 - 0.8 mm, narrowly oblong, acumin-

ate; **NSc** 1.1 - 1.6 × 1.4 - 1.9 mm, lamina somewhat bilobed, obcordate, denticulate, distinctly clawed.

M. polyphylla Haworth (Saxifrag. Enum., 2: 68, 1821). **T:** Canary Islands (*Masson* s.n. [BM]). – **D:** Canary Islands.

≡ *Petrophytes polyphylla* (Haworth) Webb & Berthelot (1841) ≡ *Sempervivum polyphyllum* (Haworth) Webb & Berthelot (1841) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum monanthes* Aiton (1789) ≡ *Monanthes monanthes* (Aiton) Lindinger (1926) (*nom. illeg.*, Art. 23.4).

M. polyphylla ssp. **amydros** Nyffeler (Bradleya 10: 73-74, ill., 1992). **T:** Canary Islands, Gomera (Nyffeler 152 [Z, ORT, ZSS]). – **D:** Canary Islands (Gomera, La Palma?).

Incl. *Monanthes amydros* Sventenius (1960) (*nom. inval.*, Art. 37.1).

[1] Differs from var. *polyphylla*: Compact tufts; **Br** decumbent, rarely ascending, 2 - 3 mm Ø; **Ros** 8 - 14 mm Ø, cylindrical in lateral view, parastichies 3:5; **L** 4 - 7 × 2 - 4 mm, ± 2 mm thick, obovate, rounded or acute.

M. polyphylla ssp. **polyphylla** – **D:** Canary Islands (Gran Canaria, Tenerife, La Palma?). **Fig. XXIII.h**

Incl. *Sempervivum monanthes* var. *filicaule* Kuntze (1891).

[1] Perennial much-branched **Ros** plants, forming dense mats of many subequal **Ros**; **Br** trailing, slender, 1 - 2 mm Ø; **Ros** 6 - 14 mm Ø, semiglobose in lateral view, the innermost **L** erect, parastichies 5:8; **L** 3 - 6 × 1 - 2 mm, ± 1 mm thick, narrowly obovate, rounded or truncate, often with some short glandular **Ha** in the lower part or glandular-hairy throughout, apically densely papillose; **Inf** terminal from the centres of the **Ros**, basally branched; **Ped** 1 - 2 cm, glandular-hairy (**Ha** ≤ 1.2 mm); **Fl** 7- to 9-merous, 4 - 6 mm Ø; **Pet** 3.1 - 4.3 × 0.4 - 0.6 mm, narrowly oblong, acute or acuminate, with glandular **Ha** (≤ 0.3 mm) along the margins; **NSc** 1.4 - 2.3 × 1.6 - 2.5 mm, lamina flabellate, retuse or obcordate, denticulate, basally attenuate.

OROSTACHYS

H. Ohba

Orostachys Fischer (Mém. Soc. Imp. Naturalistes Moscou 2: 274, 1809). **T:** *Cotyledon malacophylla* Pallas [Lectotype, designated by Borissova, Novost. Syst. Vyssh. Rast. 6: 119, 1969.]. – **Lit:** Fröderström (1931); Ohba (1990); Byalt (2000); Ohba (2001). **D:** Tadzhikistan, Kirgizia, Kazakhstan, Pakistan (Karakorum), Mongolia, China, Russia (Siberia), Korea, Japan; mostly autumn-flowering. **Etym:** Gr. 'oros', mountain; and Gr. 'stachys', spike; for the occurrence in mountainous regions, and for the inflorescence shape.

Incl. *Kungia* K. T. Fu (1988). **T:** *Crassula aliciae* Hamet.

Monocarpic succulent rosulate normally off-setting herbs, usually ± xerophytic; **R** fibrous; basal **L** forming a conspicuous **Ros** before flowering; rosulate **L** sessile, glabrous, spurless, tips often cartilaginous; flowering stems terminal, simple, laxly to ± densely leafy, erect, **L** alternate, sessile, spurless, fleshy, glabrous (to hairy), often glaucous; **Inf** thyrsoid-paniculate to thyrsoid-racemose (or simple racemes), dense, many-flowered, bracteate; **Bra** L-like; **Fl** hermaphrodite, obdiplostemonous or haplostemonous, 5- (to 6-) merous, pedicellate, opening horizontally; **Ped** often with secondary **Bra**; **Sep** green, basally connate, persistent; **Pet** always longer than the **Sep**, basally ± connate, white to pale yellow or pink; **Anth** basifixed; **NSc** mostly oblong, yellowish or whitish; **Ca** superior, separate; **Ov** basally stipitate-attenuate, erect, ventrally not gibbose, ovules many; **Sty** slender; **Sti** without papillae; **Fr** erect follicles; **Se** cylindrical, 1 - 1.5 mm, brown, longitudinally striate.

The following sections and subsections are recognized:

[1] Sect. *Orostachys*: **L** of flowering stems ± densely arranged; **Inf** thyrsoid-racemose to paniculate, densely flowered; secondary **Bra** usually present; **St** 10, obdiplostemonous.

[1a] Subsect. *Orostachys*: **L** blunt.

[1b] Subsect. *Appendiculatae* (Borissova) H. Ohba 1978: **L** cuspidate.

[2] Sect. *Schoenlandia* H. Ohba 1978: **Inf** loosely flowered racemes; **St** 5, alternating with the **Pet**.

O. aliciae (Hamet) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12(4): 160, 1978). **T:** China (*Wilson* 3627 [P]). – **D:** China.

≡ *Crassula aliciae* Hamet (1908) ≡ *Sedum aliciae* (Hamet) Hamet (1910) ≡ *Sinocrassula aliciae* (Hamet) A. Berger (1930) ≡ *Kungia aliciae* (Hamet) K. T. Fu (1988); **incl.** *Sedum aliciae* var. *genuinum* Hamet (1912) (*nom. inval.*, Art. 24.3).

O. aliciae var. **aliciae** – **D:** China (Sichuan, Gansu); flowers June to August.

[2] **Ros** 1.5 - 3.5 cm Ø; rosulate **L** oblong-ovate, 7 - 10 × 4 - 5 mm, tip rounded, base attenuate, laxly denticulate with 6 - 10 teeth on each side, densely to moderately papillate, with dense pellucid stiff unicellular **Ha** < 0.5 mm along the margins; flowering stems 10 - 35 cm tall, papillate to smooth; cauline **L** sparse, narrowly ovate to oblong-lanceolate, 7 - 15 × 4 - 6 mm, tip acute, base truncate to rounded, entire, papillate; **Inf** racemose, often with 1 - 4 lateral **Br**, 80- to 200-flowered; **Ped** 1 - 2 mm; **Sep** triangular-ovate, 1 - 1.5 mm; **Pet** white or pinkish, narrowly lanceolate, 3.5 - 4.8 mm; **St** shorter than the **Pet**; **Anth** reddish (?); **NSc** semi-orbicular, ± 0.3 mm; **Ca** 3 - 4 mm with 18 - 20 ovules each.

O. aliciae var. **komarovii** (Hamet) H. Ohba (J. Jap. Bot. 74(1): 61, 1999). **T:** China (*Potanin* s.n. [LE]). – **D:** China (Sichuan).

≡ *Sedum aliciae* var. *komarovii* Hamet (1912) ≡ *Kungia aliciae* var. *komarovii* (Hamet) K. T. Fu (1988) ≡ *Orostachys komarovii* (Hamet) Byalt (2000).

[2] Differs from var. *aliciae*: Basal **L** orbiculate; **Inf** paniculate; **Ca** 4.2 - 4.5 mm.

O. boehmeri (Makino) H. Hara (Bot. Mag. (Tokyo) 49(578): 73-74, 1935). **T** [lecto]: Japan, Hokkaido (*Boehmer* s.n. [TI]). – **D:** Japan (W Hokkaido, N Honshu); flowering September to November. **I:** Ohba (1982b: pl. 141-4, as *O. iwarenge* var.).

≡ *Cotyledon malacophylla* var. *boehmeri* Makino (1902) ≡ *Cotyledon boehmeri* (Makino) Makino in sched. (s.a.) (*nom. inval.*, Art. 29.1) ≡ *Sedum boehmeri* (Makino) Makino (1927) ≡ *Orostachys aggregata* var. *boehmeri* (Makino) Ohwi (1953) ≡ *Sedum aggregatum* var. *boehmeri* (Makino) Ohwi (1965) (*nom. inval.*, Art. 33.2) ≡ *Orostachys iwarenge* var. *boehmeri* (Makino) H. Ohba (1981) ≡ *Orostachys malacophylla* var. *boehmeri* (Makino) Hara (1985); **incl.** *Orostachys furusei* Ohwi (1954) ≡ *Sedum furusei* (Ohwi) Ohwi (1965) (*nom. inval.*, Art. 33.2) ≡ *Sedum iwarenge* var. *furusei* (Ohwi) Ohwi (1965); **incl.** *Orostachys vyschinii* Bezdeleva (1995).

[1a] **Ros** 2 - 5 cm Ø, globose, with many spreading stolons to 6 cm, stolons pale green, glabrous, with a small **L** crown at the tips; rosulate **L** obovate to spatulate or elliptic-spatulate, 2.5 - 3.5 × 0.5 - 1.5 cm, tip acute, base shortly attenuate, entire, glabrous, ± glaucous; flowering stems 3 - 6 cm tall; **Inf** densely many-flowered; **Bra** linear-lanceolate or narrowly triangular, to 4.5 mm; **Fl** almost sessile; **Sep** narrowly triangular or triangular, ± 3 mm; **Pet** white, elliptic to elliptic-lanceolate or linear, 4 - 5 mm; **St** longer than the **Pet**; **Anth** red; **NSc** oblong, ± 0.5 mm; ovules ± 20 per **Ca**.

Differing from *O. malacophylla* by the globose rosettes with numerous stolons, as well as by the triangular sepals.

O. cartilaginea Borissova (in Komarov & al. (eds.), Fl. URSS 9: 89, 368, 1939). **T:** Russia, Ussuri (*Komarov* s.n. [LE]). – **D:** E Russia, E and NE China. **I:** Ohba (1990: fig. 1).

[1b] Vegetatively similar to *O. fimbriata* except the remarkable claw-like cartilaginous appendages with sharp prickles at the **L**-tips; **Fl** solitary to 2 - 3 on an axillary **Br** with a prominent peduncle; **Sep** narrowly triangular-ovate to broadly lanceolate, 2.6 - 3.1 mm; **Pet** white or pinkish, linear-lanceolate to oblong-lanceolate, 5.5 - 6 mm, suberect; **St** slightly shorter or longer than the **Pet**; **Anth** deep red (?); **NSc** broadly oblong to square, ± 0.6 mm; **Ca** 5.5 - 6.5 mm, tapering towards the tips, ovules 10 - 12.

O. chanetii (H. Leveillé) A. Berger (NPF2 18a:

464, 1930). **T:** China, Gansu (*Chanet* s.n. [E]). – **D:** China (Shanxi, Gansu, Sichuan). **I:** Praeger (1921a: 166-167, as *Sedum*).

≡ *Sedum chanetii* H. Leveillé (1908) ≡ *Sedum fimbriatum* var. *chanetii* (H. Leveillé) Fröderström (1931); **incl.** *Sedum pyramidale* Praeger (1917).

[1b] **Ros** small, 4 - 5 cm Ø, lax; rosulate **L** linear, 2 - 2.5 cm × 2.5 - 3.5 mm, upper ¼ - ½ cartilaginous, glaucous, tip acuminate or apiculate, base rounded, entire, apical **Sp** conspicuous in winter **Ros**; flowering stem 10 - 30 cm tall; cauline **L** linear, 2 - 2.5 cm × 2.5 - 4 mm, tip cartilaginous and spinulose, glaucous; **Inf** pyramidal or oblong, dense, many-flowered, 4 - 5 cm wide, lower **Br** ascending, upper spreading, bracteate; **Bra** lanceolate; **Fl** pinkish or white, pedicellate, ± 1.3 cm Ø; **Sep** ovate or triangular-ovate, ± 1 mm; **Pet** lanceolate, 3 - 4 mm, spreading; **St** shorter than the **Pet**; **Anth** dark red-purple; **NSc** linear, ± 1 mm, pale yellow; **Ca** 3 - 4 mm, stipitate, tapering towards the tips.

O. fimbriata (Turczaninow) A. Berger (NPF2 18a: 464, 1930). **T:** Russia (*Turczaninow* s.n. [LE]). – **D:** Russia (E Siberia), Mongolia, N, NE and SW China, Tibet. **I:** Fröderström (1924: 32-34, pl. 13:2-5, as *Sedum*).

≡ *Umbilicus fimbriatus* Turczaninow (1844) ≡ *Cotyledon fimbriata* (Turczaninow) Maximowicz (1883) ≡ *Sedum fimbriatum* (Turczaninow) Franchet (1884); **incl.** *Umbilicus ramosissimus* Maximowicz (1859) ≡ *Cotyledon fimbriata* var. *ramosissima* (Maximowicz) Maximowicz (1883) ≡ *Sedum ramosissimum* (Maximowicz) Franchet (1884) ≡ *Sedum fimbriatum* var. *ramosissimum* (Maximowicz) Fröderström (1924) ≡ *Orostachys fimbriata* var. *ramosissima* (Maximowicz) A. Berger (1930) ≡ *Orostachys ramosissimus* (Maximowicz) Byalt (1998); **incl.** *Sedum limuloides* Praeger (1919) ≡ *Orostachys fimbriata* subvar. *limuloides* (Praeger) H. Jacobsen (1955); **incl.** *Sedum fimbriatum* var. *genuinum* Fröderström (1924) (*nom. inval.*, Art. 24.3); **incl.** *Orostachys fimbriata* var. *grandiflora* F. Z. Li & X. D. Chen (1989); **incl.** *Orostachys fimbriata* var. *shandongensis* F. Z. Li & X. D. Chen (1989); **incl.** *Orostachys jiuhoaensis* X. H. Guo & X. L. Liu (1991).

[1b] **Ros** 2 - 4 cm Ø; rosulate **L** linear, 8 - 15 × 3 - 4 mm, cartilaginous, tip with a spiny-denticulate or fimbriate semi-orbicular appendage; flowering stems 10 - 15 cm tall; cauline **L** linear to linear-oblongate, 1 - 3 cm × 4 - 8 mm, broadening at the base, lunate, tip with a fimbriate cartilaginous appendage; **Inf** dense, racemose but basally often branching; **Bra** linear to linear-oblongate, 0.5 - 1.5 cm, broadening at the base, tip spiny-acuminate; **Fl** pedicellate, with 2 reduced secondary narrowly ovate **Bra** to 2 mm; **Sep** narrowly ovate, 1.5 - 2 mm; **Pet** pink, linear-lanceolate or narrowly oblong, 5 - 6 mm; **St** shorter than the **Pet**; **Anth** dark purplish-red; **NSc** oblong, ± 0.4 mm, pale yellow; **Ca** 4 - 5 mm, stipitate, each with 10 - 14 ovules; **Sty** ± 2 mm.

O. japonica (Maximowicz) A. Berger (NPF2 18a: 464, 1930). **T:** Japan, Yokohama (*Maximowicz* s.n. [LE]). – **D:** Japan; flowering October to November. **I:** CBM 171: t. 287, 1957; Ohba (1982b: pl. 141-1); Lee & Lee (2000: t. 1C-F, 4A-D). **Fig. XXIV.a**

≡ *Cotyledon japonica* Maximowicz (1883) ≡ *Sedum malacophyllum* var. *japonicum* (Maximowicz) Fröderström (1931) ≡ *Orostachys erubescens* var. *japonica* (Maximowicz) Ohwi (1953) ≡ *Sedum erubescens* var. *japonicum* (Maximowicz) Ohwi (1965) (*nom. inval.*, Art. 33.2); **incl.** *Cotyledon polycephala* Makino (1910) ≡ *Sedum polycephalum* (Makino) Makino (1927) ≡ *Orostachys polycephala* (Makino) H. Hara (1935) ≡ *Orostachys erubescens* var. *polycephala* (Makino) Ohwi (1953) ≡ *Sedum erubescens* var. *polycephalum* (Makino) Ohwi (1965) (*nom. inval.*, Art. 33.2) ≡ *Orostachys japonica* fa. *polycephala* (Makino) H. Ohba (1981); **incl.** *Sedum japonicola* Makino (1927); **incl.** *Orostachys latielliptica* Y. N. Lee (2000); **incl.** *Orostachys margaritifolia* Y. N. Lee (2000).

[1b] **Ros** 0.6 - 2 cm Ø in winter, up to 8 cm Ø in summer; rosulate **L** lanceolate to subulate-lanceolate, 2.5 - 8 × 0.5 - 1.5 cm in summer **Ros**, tip spiny-acute to acuminate, grey-green to whitish-green, often reddish in winter, apical **Sp** conspicuous in winter **Ros**; flowering stems 8 - 30 cm tall; cauline **L** and **Bra** oblong-lanceolate to lanceolate, 1 - 4 cm × 4 - 6 mm, tip spiny-apiculate to spiny-acute, triangular in cross-section; **Fl** pedicellate; **Ped** 2 - 7 mm, with 2 - 5 secondary lanceolate **Bra**; **Sep** oblong-ovate, 3 - 4.5 mm, tip spiny-acute or apiculate; **Pet** white, oblong-elliptic or oblong-lanceolate, 6 - 8 mm, suberect; **St** longer than the **Pet**; **Fil** white; **Anth** dull red; **NSc** square, ± 0.6 mm, white; **Ca** 6 - 7 mm, tapering towards the tips, ovules (10-) 20 - 34. – *Cytology*: 2n = 24 (Uhl & Moran 1972).

O. malacophylla (Pallas) Fischer (Mém. Soc. Imp. Naturalistes Moscou 2: 274, 1809). **T:** Russia, Siberia (*Pallas* s.n. [BM]). – **D:** Russia, Mongolia, China, Korea, Japan.

≡ *Cotyledon malacophylla* Pallas (1776) ≡ *Sedum malacophyllum* (Pallas) Steudel (1821) ≡ *Umbilicus malacophyllus* (Pallas) De Candolle (1828); **incl.** *Umbilicus inermis* Miquel (s.a.); **incl.** *Umbilicus stamineus* Ledebour (1843).

O. malacophylla ssp. *lioutchenngoi* H. Ohba (J. Jap. Bot. 65(7): 197-199, ill., 1990). **T:** China, Inner Mongolia (*Liou Tchen-ngo* 8595 [PE]). – **D:** China (Inner Mongolia). **I:** Ohba (1990: figs. 2-3).

[1a] Differs from ssp. *malacophylla*: Flowering stems elongate; floriferous part of **Inf** < ½ of total length; **Ros** disappearing at flowering; **Pet** oblong, 5 - 6 mm.

O. malacophylla ssp. *malacophylla* – **D:** Russia (E

Siberia), Mongolia, N and NE China, Korea, Japan; flowering September to October. **I:** Fröderström (1931: pl. 3, as *Sedum*); Lee & Lee (2000: t. 3A-C, 5C-D).

Incl. *Orostachys serrata* Sweet (1830); **incl.** *Cotyledon saxatilis* Nakai (1911) ≡ *Orostachys saxatilis* (Nakai) Nakai (1942); **incl.** *Orostachys genkaiensis* Ohwi (1956) ≡ *Sedum aggregatum* var. *genkaiense* (Ohwi) Ohwi (1965) (*nom. inval.*, Art. 33.2) ≡ *Sedum iwarenge* var. *genkaiense* (Ohwi) Ohwi (1965); **incl.** *Orostachys ramosa* Y. N. Lee (2000).

[1a] (*incl.* var. *malacophylla*) **Ros** 4 - 15 cm Ø, rosulate **L** oblong to oblong-spatulate, 1.5 - 7 (-10) × 1 - 3 cm, tip rounded to obtuse, green to pale green; flowering stem 10 - 20 cm tall; cauline **L** spatulate or narrowly obovate, 1.5 - 3 × 1 - 1.5 cm, tip rounded; **Bra** broadly obovate to broadly oblong-obovate, 6 - 10 × 4 - 5 mm, tip acute to acuminate, margins minutely erose, uppermost **Bra** ovate to broadly lanceolate with acute tip, 5 - 7 mm; **Fl** pedicellate; **Sep** narrowly ovate, 3 - 5 mm; **Pet** white, broadly oblong to oblong or broadly obovate, 5 - 7 mm; **St** conspicuously longer than the **Pet**; **Anth** deep purplish-red; **NSc** oblong, ± 0.5 mm, cream; **Ca** 4 - 7 mm, stipitate, ovules 20 - 34; **Sty** ± 1.5 mm. – *Cytology*: 2n = 24 (Uhl & Moran 1972).

O. malacophylla var. *aggregata* (Makino) H. Ohba (J. Jap. Bot. 67(4): 200, 1992). **T:** Japan (*Yasuda* s.n. [MAK]). – **D:** Japan (Hokkaido, N Honshu). **I:** Ohba (1982b: pl. 141-2, as *O. malacophylla*).

≡ *Cotyledon aggregata* Makino (1910) ≡ *Sedum aggregatum* (Makino) Makino (1927) ≡ *Orostachys aggregata* (Makino) H. Hara (1935) ≡ *Sedum iwarenge* var. *aggregatum* (Makino) Ohwi (1965); **incl.** *Orostachys aggregata* fa. *rosea* Sugaya (1956) ≡ *Orostachys malacophylla* fa. *rosea* (Sugaya) H. Ohba (1981).

[1a] Differs from ssp. *malacophylla*: **Ros** sometimes glaucous and stoloniferous; **Pet** linear to oblong with obtuse tip; **Anth** deep purplish-red.

O. malacophylla var. *iwarenge* (Makino) H. Ohba (J. Jap. Bot. 67(4): 200, 1992). **T** [lecto]: Japan, Honshu (*Anonymus* s.n. [TI]). – **D:** Japan (cultivated). **I:** Fröderström (1931: pl. 2, as *Sedum*); Ohba (1982b: pl. 141-3, as *O. iwarenge*); Lee & Lee (2000: t. 2A-D, 5A-B).

Incl. *Cotyledon malacophylla* var. *japonica* Franchet & Savatier (1878); ≡ *Cotyledon iwarenge* Makino (1902) ≡ *Sedum iwarenge* (Makino) Makino (1927) ≡ *Sedum malacophyllum* var. *iwarenge* (Makino) Fröderström (1931) ≡ *Orostachys iwarenge* (Makino) H. Hara (1935); **incl.** *Orostachys iwarenge* fa. *albomarginata* Sugimoto (1958); **incl.** *Orostachys iwarenge* fa. *albovariegata* Sugimoto (1958); **incl.** *Orostachys iwarenge* fa. *aureomarginata* Sugimoto (1958); **incl.** *Orostachys iwarenge* fa. *luteomedia* Sugimoto (1958); **incl.** *Orostachys*

chongsunensis Y. N. Lee (2000); **incl.** *Orostachys iwarenge* fa. *magna* Y. N. Lee (2000).

[1a] Differs from ssp. *malacophylla*: **Ros** always glaucous, hardly stoloniferous; **Pet** narrowly oblong with rounded tip; **Anth** deep yellow. – *Cytology*: $2n = 24$ (Uhl & Moran 1972).

Byalt (2000: 44) recently described *O. maximo-wiczii* for the taxon allegedly confused by most authors with *O. iwarenge*. It is said to differ from the true *O. iwarenge* by narrower, acute and green leaves, acute petals and trapezoid nectary scales (instead of spatulate). [Ed.]

O. paradoxa (A. P. Khokhrjakov & Voroschilov) Czerepanov (Vasc. Pl. Russia Adjac. States 193, 1995). **T**: Russia, Primorsky Kray (Voroschilov & Khokhrjakov s.n. [MHA]). – **D**: Russia (E Siberia: Sikhote-Alin Mts.). **I**: Byalt (1998).

≡ *Sedum paradoxum* A. P. Khokhrjakov & Voroschilov (1970).

[1a] Caespitose with rope-like main **R** and numerous above-ground shoots; flowering stems 3 - 15, simple, terete, ascending with curved base, diffusely leafy; sterile stems numerous, prostrate, with an apical **L** cluster; **L** opposite, sessile, spurless, broadly ovate, 9 - 12 × 2 - 7 mm, glabrous, tip acuminate to acute, grey-blue tinged lilac with narrow lilac longitudinal stripes, margins entire; **Inf** spicate, simple, many-flowered; **Bra** similar to the **L** in shape but small; **Fl** 4- or 5-merous, pedicellate; **Ped** 1 - 2 mm; **Sep** oblong-ovate, acuminate, free nearly to the base, a little shorter than the **Pet**; **Pet** broadly oblong, 4 - 5 mm, acuminate or apiculate, erect, white or pale yellow with purple carinate midveins; **St** slightly longer than the **Pet**; **Anth** dark violet; **NSc** oblong, ± 0.5 mm; **Ca** shorter than the **St**, base stipitate; **Sty** slender.

Intermediate between the genera *Orostachys* and *Hylotelephium*.

O. schoenlandii (Hamet) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12(4): 160, 1978). **T**: China (Wilson 3622 [P]). – **D**: China (Sichuan). **I**: Fröderström (1924: pl. 14.1); Fröderström (1931: pl. 6.3, both as *Sedum*).

≡ *Sedum schoenlandii* Hamet (1910) ≡ *Sinocrassula schoenlandii* (Hamet) S. H. Fu (1965) ≡ *Kungia schoenlandii* (Hamet) K. T. Fu (1988).

[2] **Ros** small, 1 - 3 cm Ø with 20 - 40 **L**; rosulate **L** oblanceolate to oblong-oblanceolate, 5 - 15 × 1.2 - 1.8 mm, entire, densely hairy on both faces, tip rounded; flowering stems 7 - 23 cm tall, densely hairy in the lower part; cauline **L** linear-elliptic to oblong-oblanceolate, 8 - 14 × 3 - 4 mm, tip rounded or obtuse, glabrous; **Inf** racemose, 30- to 80-flowered, 4 - 6 × 1 - 3 cm Ø; **Bra** narrowly lanceolate to linear-elliptic, 5 - 8 × 1 - 2 mm, tip acute; **Fl** pedicellate; **Sep** narrowly oblong-ovate, 1.2 - 1.5 mm; **Pet** white, lanceolate, 4.5 - 6 mm; **St** conspicuously shorter than the **Pet**; **Anth** reddish (?); **NSc**

broadly obovate, ± 0.3 mm; **Ca** 4.2 - 5 mm, ovules 6 - 10; **Sty** 1.2 - 1.5 mm.

O. spinosa (Linné) C. A. Meyer ex A. Berger (NPF2 18a: 464, 1930). **T**: LINN 400.10. – **D**: Russia (E Siberia), Mongolia, N and NE China, N Korea; flowers July to August. **I**: Fröderström (1931: pl. 5.1, as *Sedum*); Lee & Lee (2000: t. 1A, 1B).

≡ *Cotyledon spinosa* Linné (1753) ≡ *Crassula spinosa* (Linné) Linné (1771) ≡ *Sedum spinosum* (Linné) Thunberg (1784) ≡ *Umbilicus spinosus* (Linné) De Candolle (1828); **incl.** *Sempervivum cuspidatum* Haworth (1803); **incl.** *Orostachys chlorantha* Fischer (1809); **incl.** *Cotyledon spinosa* var. *polystachya* Ledebour (1830); **incl.** *Umbilicus erubescens* Maximowicz (1859) ≡ *Cotyledon erubescens* (Maximowicz) Franchet & Savatier (1878) ≡ *Orostachys erubescens* (Maximowicz) Ohwi (1942) ≡ *Sedum erubescens* (Maximowicz) Ohwi (1965) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon minuta* Komarov (1901) ≡ *Orostachys minuta* (Komarov) A. Berger (1930) ≡ *Sedum spinosum* var. *minutum* (Komarov) R. Stephenson (1994) (*nom. inval.*, Art. 33.2); **incl.** *Cotyledon filifera* Nakai (1919) ≡ *Orostachys filifera* (Nakai) Nakai (1942); **incl.** *Orostachys kanboensis* Ohwi (1942); **incl.** *Orostachys minuta* fa. *alba* Y. N. Lee (1998) (*nom. inval.*, Art. 36.1).

[1b] **Ros** 3 - 6 cm Ø; rosulate **L** narrowly oblong, 1.5 - 2.8 cm × 4 - 7 mm, tip with an appendage 3 - 5 mm long, cartilaginous, entire or irregularly incised, lunate, ending in a prickle 2 - 4 mm long; flowering stems 10 - 30 cm tall; cauline **L** and **Bra** narrowly oblong to linear or linear-lanceolate, 6 - 15 × 2 - 5 mm, tip acute or acuminate with a prickle; **Inf** racemose, dense, cylindrical, 5 - 20 cm, many-flowered; **Fl** shortly pedicellate; **Ped** < 2 mm, with 2 - 3 narrowly ovate or lanceolate secondary **Bra** 1 - 3 mm long; **Sep** ovate or oblong-ovate, 2 - 3 mm, tips spiny-cuspidate or spiny-acuminate; **Pet** yellowish (rarely whitish), narrowly oblong or narrowly oblong-lanceolate, 4.5 - 6 mm; **St** longer than the **Pet**; **Anth** yellow; **NSc** oblong, ± 0.5 mm, white; **Ca** 4 - 5.5 mm, ovules 16 - 24; **Sty** ± 1 mm.

O. stenostachya (Fröderström) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12(4): 162, 1978). **T**: China (Hamel 3601 [S]). – **D**: China (Gansu). **I**: Fröderström (1932: pl. 62, as *Sedum*).

≡ *Sedum stenostachyum* Fröderström (1932) ≡ *Sinocrassula stenostachya* (Fröderström) S. H. Fu (1965) ≡ *Kungia schoenlandii* var. *stenostachya* (Fröderström) K. T. Fu (1988); **incl.** *Sinocrassula stenostachya* var. *integrifolia* S. H. Fu (1965) ≡ *Orostachys stenostachya* var. *integrifolia* (S. H. Fu) Byalt (2000); **incl.** *Sinocrassula stenostachya* var. *lepidotricha* K. T. Fu (1974) ≡ *Kungia schoenlandii* var. *lepidotricha* (K. T. Fu) K. T. Fu (1988) ≡ *Oro-*

stachys stenostachya var. *lepidotricha* (K. T. Fu) Byalt (2000).

[2] **Ros** to 3 cm Ø; rosulate **L** oblong-spatulate or broadly oblanceolate, 10 - 15 × 5 - 7 mm, glabrous, apical part shallowly trilobate or 3- to 5-dentate, tip acute; flowering stems 10 - 30 cm tall, glabrous; cauline **L** narrowly obovate, 8 - 10 × 3 - 6 mm, 3- to 5-dentate, tip acute; **Inf** spicate, few-flowered; **Bra** lanceolate, to 1 cm; **Fl** pink, pedicellate; **Sep** triangular, ± 1.5 mm; **Pet** triangular-lanceolate, ± 4 mm; **St** shorter than the **Pet**; **NSc** spatulate, ± 0.3 mm; **Ca** 3 mm.

O. thyrsoflora Fischer (Mém. Soc. Imp. Naturalistes Moscou 2: 274, 1809). **T:** Russia, Siberia (*Tauscher* s.n. [LE]). – **D:** Tadzhikistan, Kirgizia, Kazakhstan, Pakistan (Karakorum), Russia (Altai, Ural), Mongolia, China (Xingjian: Tien-Shan); flowers July to August. **I:** Fröderström (1931: pl. 4, as *Sedum spinosum* var.). **Fig. XXIV.b**

≡ *Umbilicus thyrsoflorus* (Fischer) De Candolle (1828) ≡ *Cotyledon thyrsoflora* (Fischer) Maximowicz (1883) ≡ *Sedum spinosum* var. *thyrsoflorum* (Fischer) Fröderström (1931); **incl.** *Cotyledon leucantha* Ledebour (1830); **incl.** *Cotyledon rosea* Lessing (1834) ≡ *Orostachys thyrsoflora* var. *rosea* (Lessing) Byalt (2000).

[1b] **Ros** 2 - 5 cm Ø; rosulate **L** narrowly oblong to linear-triangular, 1 - 2.3 cm × 4 - 7 mm, with 3 - 5 mm long cartilaginous denticulate lunate or triangular appendage ending in a prickle 1.5 - 2 mm long; flowering stems 5 - 20 cm tall; cauline **L** narrowly oblong to linear-lanceolate, 4 - 10 × 2 - 4 mm, tip prickly-acuminate or prickly-cuspidate; **Inf** racemose, 3 - 15 cm, many-flowered, lax, cylindrical to long-conical; **Fl** pedicellate, with 2 or 3 lanceolate secondary **Bra** 1 - 3 mm long; **Sep** broadly triangular-ovate, 1.5 - 2 mm, prickly-acuminate; **Pet** white or pinkish, narrowly oblong to narrowly oblong-lanceolate, 4.5 - 6 mm; **St** nearly as long as the **Pet**; **Anth** deep purple-red; **NSc** oblong, ± 0.5 mm, white; **Ca** 4 - 5.5 mm.

Differs from *O. spinosa* by white or pinkish prominently pedicellate flowers with broadly triangular-ovate sepals, and carpels nearly equalling the petals in length, as well as a broader and more lax inflorescence.

×PACHYLADIA

U. Eggli

×**Pachyladia** C. H. Uhl (CSJA 66(5): 216, 1994).

= *Pachyphytum* × *Villadia*. See Uhl (1994c) for a list of known hybrid combinations (none formally named).

PACHYPHYTUM

J. Thiede

Pachyphytum Link & al. (Allg. Gartenzeitung 9(2): 9-10, 1841). **T:** *Pachyphytum bracteosum* Link & al. [Typification by inference, only element included.]. – **D:** E-C Mexico; rocky places, (600-) 1200 - 2500. **Etym:** Gr. 'pachys', thick, stout; and Gr. 'phyton', plant; for the usually thick leaves.

Incl. *Diotostemon* Salm-Dyck (1845). **T:** *Diotostemon hookeri* Salm-Dyck [Typification by inference, only element included.].

Perennial glabrous **Ros** plants; stems first erect, 15 - 50 (-70) cm, mostly decumbent with age to pendent and to ≥ 1 m, 0.6 - 2.5 (-3.5) cm Ø, simple or mostly basally (rarely further up) few-branched; **Ros** 6 - 20 cm Ø, with 10 - 40 (-80) mostly ± conspicuously separate **L** (esp. below, but generally more densely arranged towards **Br** tips) in ⅓ arrangement (always?); **L** young often ± erect, later ± spreading, old often ± recurved, ± obovate to spatulate or elliptic-oblong or (ob-) lanceolate, (±) obtuse to acute, rarely mucronate, mostly ± conspicuously glaucous-farinoe, upper face usually ± flat or slightly convex to concave, lower face ± rounded; **Inf** lateral from the **Ax** of the upper (to middle) **L**, ± erect, lower (4-) 10 - 20 (-26) cm **L**-less, above with (3-) 6 - 9 (-12) **Bra**, **Bra** **L**-like, mostly caducous at flowering time, basally (always?) spurred; **Inf** scorpioid, almost always simple, first ± strongly arching over, later almost always ± erect to ascending, with (3-) 6 - 28 (-50) **Fl**, 2 - 25 (-36) cm, fertile **Bra** first usually ± overlapping, ± elliptic to (ob-) ovate or lanceolate, basally often ± sagittate to amplexicaul or spurred with ± 2 teeth; **Ped** 2 - 15 (-38) mm, thickened towards tip; **Fl** 5- (rarely 6-) merous, obdiplostemonous; **Sep** erect, placed against the **Cl**, shape very variable, mostly (often strongly) unequal; **Cl** tubular, barrel-shaped or campanulate, sometimes 5-angled, 5.5 - 17 × 3.5 - 10 (basal) to 4.5 - 17 (apical) mm Ø, white to rose-coloured, rarely orange to red or reddish; **Pet** ± oblong to oblanceolate, 7 - 17 × 2.5 - 6 mm, tube 0.2 - 1.8 mm, mostly ± 0.5 mm, lobes basally erect and ± open, apically overlapping in bud, at anthesis mostly ± spreading to recurved above the middle, acute to obtuse, inside in the upper middle or below the tip often with a ± red spot, laterally near the base with appendages which form 2 free 0.5 - 2 × 1 - 2 mm large **Sc** beneath the **Fl** and thus close the lower nectar-containing part of the **Cl**; **St** in 2 series; epipetal **Fl** fused with the **Cl** for (1.5-) 2 - 4 mm, episepal **Fl** completely or almost free; **NSc** 0.3 - 0.9 × 1 - 2.8 mm, ± yellowish (-white); **Ca** first always erect, ± free, with numerous ovules, 4 - 10 × 3 - 6 mm (**Ov** + **Sty**); **Sty** inconspicuously offset to abruptly narrowing, 1 - 2 (-3) mm, ± green to greenish or red; **Fr** mostly ± divergent, partly or ± completely opening along the suture; **Se** ± obovoid, (0.3-) 0.5 - 0.8 × 0.25 - 0.4 mm, testa cells smooth-concave (al-

ways?), $\pm$ red-brown. – *Cytology*: $n = 31, 32, 33, 62, 64, 66, \pm 93 - 96, 96, 99, \pm 124, \pm 128, \pm 160, \pm 186$ (Uhl & Moran 1973).

The genus is esp. characterized by the scale-like appendages of the corolla lobes. These scales are outgrowths of the petal margins (Leinfellner 1954). The former *P. amethystinum* lacks such scales and also differs caryologically (Uhl & Moran l.c.) and is therefore now placed in *Graptopetalum*. Less conspicuous petal appendages are also found in some species of *Echeveria* (e.g. *E. heterosepala*), but the homology with the scales of *Pachyphytum* remains to be proved. Intergeneric hybrids are known with the following genera: *Echeveria* (= $\times$ *Pachyveria*), *Graptopetalum* (= $\times$ *Graptophytum*), *Lenophyllum* (= $\times$ *Lenophytum*), *Sedum* (= $\times$ *Pachysedum*), *Thompsonella* (= $\times$ *Thompsophytum*), and *Villadia* (= $\times$ *Pachyladia*).

Pachyphytum appears to be closest to *Echeveria*, based on the upright corolla fused for most of its length in both genera. The closest affinities seem to be with the sections *Angulatae* (incl. *Pruinosae*), *Secundae* and *Urceolatae* of *Echeveria*, which share the presence of mainly single (to trifid) cincinnoid inflorescences with *Pachyphytum* (Uhl 1996b). Whereas the first two sections differ from *Pachyphytum* in their chromosome numbers of $x=12-15$ and $x=14-17$ (both behaving as polyploids in crossing experiments), Sect. *Urceolatae* agrees with *Pachyphytum* not only in its karyology with $x=26-34$, but also in the behaviour as diploids in crossing experiments (Uhl 1996b). Consequently, *Pachyphytum* appears to be nested within *Echeveria* rendering the latter paraphyletic. This would call for recognizing *Pachyphytum* as a mere (though characteristic) section of *Echeveria*.

The flowers of *Pachyphytum*, which in lateral view are often completely hidden by the bracts and sepals, are probably pollinated by hummingbirds (Moran 1989).

Pachyphytum can be divided as follows:

- [1] Sect. *Diotostemon* (Salm-Dyck) E. Walther 1931: **L** densely arranged, mostly touching each other, $\pm$ terete to cylindrical, width : thickness ratio mostly clearly < 2 ; floral **Bra** 5 - 9 mm, basally truncate or at the most weakly 2-toothed, not sagittate and amplexicaul; **Sep** almost equal, shorter than the **Pet**; **Pet** erect, without a red spot; **Fil** apically not red. – *Cytology*: $x = 31, 32$.
- [2] Sect. *Pachyphytum* (incl. Sect. *Ixiocaulon* Moran 1968): **L** $\pm$ laxly arranged, not or hardly touching each other (dense in *P. oviferum*), $\pm$ flattened (almost terete in *P. viride*), width : thickness ratio almost always clearly > 2 ; **Bra** 13 - 30 mm (only 9 mm in *P. caesium* and 7 - 10 mm in *P. garciae*), basally $\pm$ sagittate and amplexicaul, first $\pm$ densely imbricate; **Sep** $\pm$ unequal, mostly longer than the **Pet** (partly shorter in *P. caesium*, *P. glutinicaule* and *P.*

fittkaui); **Pet** $\pm$ spreading to divaricate near the tips, with a red spot (absent in *P. fittkaui* and *P. glutinicaule*); **Fil** apically red (except *P. oviferum*). – *Cytology*: $x = 33$ (uncertain for *P. fittkaui*).

[2a] *P. oviferum* Group: **L** broadest near tips; **Pet** 7 - 11 mm.

[2b] *P. werdermannii* Group: **L** broadest at or near the middle (above the middle in *P. fittkaui*); **Pet** (8-) 10 - 17 mm.

Due to the reticulate distribution of characters, the position and relationships of some species are difficult to establish. This is esp. true for *P. machucae*, *P. caesium* and *P. garciae*.

P. bracteosum Link & al. (Allg. Gartenzeitung 9(2): 10, 1841). **T**: Mexico (*Ehrenberg* s.n. [not preserved]). – **D**: Mexico (Hidalgo: region of the Barranca de Metztitlán); on rocks, 1200 - 1800 m. **I**: Moran (1989).

= *Echeveria bracteosa* (Link & al.) Lindley & Paxton (1853); incl. *Cotyledon pachyphytum* Baker (1869) = *Echeveria pachyphytum* (Baker) Morren (1874).

[2a] Stems erect or decumbent, $\geq 30 \times 1 - 2.5$ cm, simple or few-branched near the base; **Ros** with 15 - 35 somewhat distant **L**; **L** obovate to spatulate, obtuse to rounded or slightly truncate, 4 - 11 $\times$ 2.5 - 5 cm, 6 - 14 mm thick, glaucous, often $\pm$ rose-coloured; **Inf** 15 - 40 cm, lower 12 - 20 cm **Bra**-less, above with 6 - 10 sterile **Bra**, glaucous, often reddish, upper 8 - 25 cm with 10 - 28 **Fl**; fertile **Bra** first overlapping, elliptic, sagittate, 13 - 27 $\times$ 7 - 14 mm; **Ped** 3 - 6 mm; **Cal** 12 - 24 $\times$ 12 - 17 mm; **Sep** distinctly unequal, 9 - 22 $\times$ 3 - 13 mm; **Cl** 5-angled, 13 mm $\varnothing$, rose-coloured; **Pet** rhombic to oblanceolate, 9 - 11 $\times$ 3 - 5 mm, tube $\pm$ 0.5 mm, lobes ascending-divaricate from above the middle, upper face near the tip with a roundish dark red spot; **Pet** scales present; **Fil** 6 - 9.5 mm, epipetal **Fil** fused with the **Cl** for 2 - 3 mm, apically red; **NSc** 0.6 - 0.9 $\times$ 1.5 - 2.5 mm, white or yellowish; **Ca** free, 5.5 - 8 $\times$ 2 - 3 mm, basally yellowish-white, above dark red; **Sty** indistinct, 1 - 2 mm. – *Cytology*: $n = 33, 66$.

According to Moran (1989), the closest relatives are *P. oviferum* and *P. longifolium*. As no original herbarium material is known to exist, the plate of the type plant in Icon. Pl. Rar. Hort. Reg. Bot. Berol. 2: t. 43 (1844) could be selected as lectotype.

P. brevifolium Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 12, 1905). **T**: Mexico, Guanajuato (*Dugès* 155 [GH, US]). – **Lit**: Moran (1963); Meyrán (1997); Pérez-Calix & Glass (1999); all with ill. **D**: Mexico (Guanajuato); rocks in oak forest, 2000 - 2150 m.

[1] Perennial **Ros** plants; stems prostrate, decumbent to pendent, to 1 m, simple or branched and for-

ming dense colonies; **L** scattered along the upper stem parts, more densely packed and **Ros**-like at the stem tip, elliptic narrowly obovate, tip rounded or broadly obtuse, 10 - 30 × 5 - 10 mm, dark green, sometimes brownish-red, glaucous, tinged dark red at the tip; **Inf** 6- to 10-flowered, scape 6 - 8.5 cm; **Bra** elliptic-ovate, 6 - 8 × 2 - 3 mm, floral **Bra** not imbricate; **Ped** 4 - 15 mm, reddish; **Sep** erect, appressed to the **Cl**, as long as or 1 - 3 mm shorter than the **Cl**, elliptic-ovate, obtuse to rounded, unequal, 5 - 7 × 2 mm, glaucous; **Cl** subcampanulate, erect to slightly recurved at anthesis; **Pet** oblong-oblancheolate, obtuse, apiculate, 6 - 7 × 2 - 3 mm, rose-yellowish to red, tip greenish, tube very short, scales ± 1.5 mm broad, yellow; **NSc** ± 1 mm wide; **Ca** erect, 3 - 5.5 mm; **Sty** 1 mm.

This species was long only known from the type collection (type number erroneously given as '153' in the protologue) and was provisionally placed in Sect. *Diotostemon* (Moran 1963). It was also misidentified with plants later described as *P. glutinicaule*. Meyrán (1997) interprets material of unknown horticultural origin as this species and gives a detailed description, but places it with reservation in Sect. *Pachyphytum*. Finally, Pérez-Calix & Glass (1999) convincingly identified *P. brevifolium* with 3 recent collections from near Guanajuato, where the type was collected without exact locality. According to the leaf shape, the small and non-imbricate basally truncate floral bracts, and the uniformly coloured petals, *P. brevifolium* is here placed in Sect. *Diotostemon*. However, it approaches the putatively more basal species of Sect. *Pachyphytum* in its unequal sepals being as long as or slightly shorter than the petals (Pérez-Calix & Glass 1999). The coloration of the sepals and petals has erroneously been transposed in their description.

P. caesium Kimnach & Moran (CSJA 70(1): 41, 1998). **T**: Mexico, Aguascalientes (*Minnich* 12101 [HNT, MEXU]). – **D**: Mexico (Aguascalientes); 2000 m, only known from 2 localities. **I**: CSJA 65: 59-62, 1993.

[2a] Stems erect, later decumbent-pendent, ≥ 30 × (1-) 1.5 - 2.1 cm; **Ros** consisting of the uppermost 3 - 10 cm of the stems; **L** obovate to oblong, apically rounded to broadly obtuse, first ascending, later spreading and somewhat upcurved, ± 4 - 30 mm distant from each other, 3 - 5 (-6.5) × (1-) 2 - 3.6 cm, 10 - 14 mm thick, young intensely glaucous-pruinose, later rose-grey or greenish-grey and not glaucous; **Inf** mostly simple, rarely with up to 3 scorpioid **Br**, lower 5 - 15 cm **L**-less, above with ± 6 caducous sterile **Bra**, 29 - 35 cm long or longer, upper 5 - 7 cm with 6 - 18 **Fl**; fertile **Bra** somewhat overlapping, elliptic, ± obtuse, ± 9 × 5 mm, greenish-grey; **Ped** 3 - 5 (-18) mm; **Cal** 9 - 12 × ± 8 mm, grey-green, glaucous-pruinose; **Sep** oblong, obscurely mucronate, unequal, 7 - 9 × 2 - 6 mm; **Cl** 9 - 10

× 7 - 8 mm, mostly ± 1 mm longer than the **Cal** (rarely shorter), inside greenish-cream with deep rose-red, outside rather pale reddish; **Pet** oblong-oblancheolate, 2 - 3.5 mm broad, tube ± 0.5 mm, lobes basally erect, above somewhat recurved, broadly pointed, apically with broad deep rose-coloured spot; **Sc** of the **Pet** brownish-red; **Fil** ± 8 - 9 mm, epipetal **Fil** fused with the **Cl** for ± 4 mm, greenish-yellow, reddened above; **NSc** ± 0.5 × 1.5 - 2 mm, pale yellow; **Ca** 7 - 8 mm, pale greenish-yellow; **Sty** ± 1 mm, greenish to greenish-brown. – *Cytology*: n = 33.

P. coeruleum J. Meyrán (Cact. Suc. Mex. 8: 86-91, 99, ill., 1963). **T**: Ex cult. (*Meyrán* 523 [MEXU 52609]). – **D**: Only known from cultivation. **I**: NCSJ 20: 37-38, 1965; Lucas (2002). **Fig. XXIV.c**

[1] Stems erect, later decumbent to pendent, to 25 × 1 cm, basally more strongly branched; **L** clustered, dense, lanceolate, almost cylindrical, fusiform, basally tapering, somewhat curved, 2 - 3 × 0.5 - 1.2 cm, 4 - 10 mm (basally 4 - 5 mm) thick, glaucous-pruinose, basally pale green, mucronate with a 1 mm long pale green or yellow mucro; **Inf** 4 - 9 cm, with 7 - 9 linear-lanceolate sterile **Bra**, pale green, floriferous part 2 - 5 cm with 6 - 10 **Fl**; fertile **Bra** lanceolate, pale green, apically darker, basally white; **Ped** 7 - 10 mm, pale yellow, sometimes tinged rose-red; **Fl** 10 × 6 mm; **Sep** triangular-ovate, 6 × 3 (basally) mm, pale yellow, sometimes basally rose-red, apically grey-green; **Cl** 8 - 9 × 5 mm, pale yellow, apically greenish; **Pet** oblong-oblancheolate, 8 × 3 - 3.5 mm, tube absent (?), lobes acute, somewhat keeled; **Sc** of the **Pet** triangular, yellow; **Fil** 4 - 5 mm, basally yellow, apically pale green; **NSc** trapezoid, somewhat indented in the middle, 0.5 × 2 mm; **Ca** 5 - 6 × 1.5 mm, basally yellow, above pale green. – *Cytology*: n = 31.

In habit, this taxon suggests a hybrid *Pachyphytum* × *Sedum* (esp. *S. morganianum*). Meyrán refuses this possibility in the protologue, however, as the flowers concur completely with *Pachyphytum*.

P. compactum Rose (CUSNH 13(9): 301, pl. 61, 1911). **T**: Mexico, Hidalgo (*Purpus* s.n. [US 574 499, NY, US]). – **D**: Mexico (Querétaro, Hidalgo); rocky slopes, 1900 - 2100 m. **I**: CSJA 63: 30-34, 1991. **Fig. XXIV.d**

Incl. *Pachyphytum compactum* var. *weinbergii* E. Walther (1934).

[1] Stems to 15 × 0.6 - 1.8 cm (pendent to 40 cm), often basally branched; **Ros** with (15-) 30 - 80 mostly congested **L** in the uppermost 4 - 15 cm of the stems; **L** ovate to broadly pointed, somewhat tere, upper face with ± 4 planes resulting from the pressure of neighbouring **L**, 2 - 4 × 0.8 - 1.6 cm, 6 - 12 mm thick, matted green or often tinged violet, glaucous-pruinose; lower 4 - 13 cm of the **Inf** **L**-less, above with 6 - 12 appressed sterile **Bra**, (15-) 25 - 40 cm, pale green or ± violet, upper 2 - 17 cm

with 3 - 11 **Fl** and reddish; fertile **Bra** not overlapping, elliptic-ovate, acute, basally truncate or 2-toothed, 5 - 9 × 2 - 4 mm; **Ped** (5-) 10 - 38 mm; **Cal** 6 - 10 × 6 - 10 mm, deep rose-coloured, apically green or ± violet; **Sep** triangular-ovate to -lanceolate, acute, often pointed, (almost) equal, 3 - 8 × 2 - 5 mm; **Cl** barrel-shaped to weakly campanulate, 7 - 11 × 6 - 11 mm, red to orange, apically dark green or dark violet, glaucous-pruinose; **Pet** obovate-spatulate, 3.5 - 6 mm broad, tube ≤ 0.5 mm, lobes erect; **Sc** of the **Pet** 3 - 5.5 mm above the **Pet** base, to 1.5 mm; **Fil** 5 - 8 mm, epipetal **Fil** fused with the **Cl** for 2 - 4 mm, yellowish; **NSc** 0.3 - 0.6 × 1.2 - 2.8 mm, yellowish; **Ca** 4.5 - 7.5 × 1.2 - 2.5 mm, placed against each other, almost free, basally yellowish, above yellow; **Sty** abruptly attenuate, 1 - 2 mm. – *Cytology*: $n = 31, 62, \pm 124, \pm 186$.

Distinguished from all other species of the genus by the impressions left on the upper leaf surface by the neighbouring leaves. At the only known locality where 2 species of the genus occur together, *P. compactum* forms natural hybrids with *P. viride* (Moran 1968).

P. fittkaui Moran (CSJA 43(1): 26-32, ills., 1971). **T**: Mexico, Guanajuato (Moran 14770 [SD, NY]). – **D**: Mexico (E Guanajuato, S San Luis Potosí); 1200 - 2100 m. **Fig. XXIV.g**

[2b] Stems 50 (-70) × 1.5 - 3.5 cm (decumbent or pendent to > 1 m), branched predominantly from the base, **L** scars with 1 **L** trace; **Ros** 10 - 20 cm Ø, with 10 - 25 (in cultivation to 40) laxly arranged **L** in the uppermost 5 - 12 cm of the stems; **L** ± elliptic to oblanceolate or obovate, pointed, 3 - 9.5 × 2 - 4 cm, 9 - 15 mm thick, deep green or tinged somewhat violet-red, young somewhat glaucous-pruinose; lower 4 - 15 cm of the **Inf L**-less, above with 4 - 12 caducous sterile **Bra**, (20-) 30 - 55 cm, violet-red, upper 10 - 20 cm with 12 - 25 **Fl**; fertile **Bra** first densely overlapping, obliquely ovate, 12 - 25 × 7 - 12 mm, green or somewhat glaucous-pruinose; **Ped** 2 - 6 mm; **Cal** 11 - 23 × 7 - 14 mm, green and somewhat glaucous-pruinose; **Sep** unequal, 9 - 21 × 3 - 11 mm; **Cl** pentagonal, ± 4 mm shorter to 4 mm longer than the **Cal**, 12 - 17 × 10 - 15 mm (apically), ± deeply rose-coloured; **Pet** triangular-lanceolate, tube ≤ 1 mm, lobes ascending from above the middle, 3.5 - 5 mm broad; **Sc** of the **Pet** ± 5.5 - 8 mm above the **Cl** base, ± 0.5 - 1.5 mm; **Fil** 6 - 11 mm, epipetal **Fil** fused with the **Cl** for 3 - 4 mm, red above; **NSc** 2 - 2.5 mm broad, yellowish; **Ca** 6 - 10 × 2 - 3 mm; **Sty** conical, 1 - 1.5 mm, red. – *Cytology*: $n = \pm 66, \pm 93, \pm 93-96$.

Moran speculates in the protologue that this species could on the base of its intermediate characters represent an allopolyploid hybrid between Sect. *Pachyphytum* and the here synonymized Sect. *Ixiocaulon*.

P. garciae Pérez-Calix & Glass (Acta Bot. Mex. 48:

4,6-7, ills., 1999). **T**: Mexico, Querétaro (Pérez-Calix & Zamudio 3574 [IEB]). – **D**: Mexico (Querétaro); calcareous rocky slopes, 1600 m, only known from the type locality.

[2a] Perennial **Ros** plants; stems decumbent to pendent, to 30 × 0.6 cm, simple or basally branched; **Ros** dense or lax in the lower parts, 5 - 8 cm Ø; **L** elliptic, elliptic-oblanceolate, obovate or obovate-spatulate, 1.5 - 4.5 × 0.8 - 2.3 cm, glaucous bluish-green, tip broadly acute to rounded, mucronulate, tinged purple; **Inf** 20 cm; **Bra** few, obovate to elliptic, 6 - 11 × 2 - 6 mm, tip obtuse to rounded, ± apiculate; floral **Bra** not imbricate; **Ped** 3 - 8.5 mm; **Sep** erect, appressed, ± as long as the **Cl**, oblong, obtuse to rounded, subequal, 6.5 - 9 × 2 - 5 mm; **Pet** oblong-oblanceolate, acute, slightly apiculate, 8 × 2.5 - 3 mm, rose, centrally darker, basally yellowish, tube > 0.5 mm, scales 1 × 0.5 mm; **Fil** 8 or 10 mm, epipetalous **Fil** fused ± 3 mm with the **Cl**, yellowish below, rose above; **NSc** ± 1 mm broad; **Ca** ± 4 mm, yellow; **Sty** ± 1 mm, rose.

Closest to *P. caesium* and *P. fittkaui* according to the protologue.

P. glutinicaule Moran (CSJA 35: 35-41, ills., 1963). **T**: Mexico, Hidalgo (Moran & Kimnach 7805 [SD, DS, NY, UC, US]). – **D**: Mexico (Hidalgo); N-exposed rock cliffs, 1200 - 1550 m. **I**: Cact. Suc. Mex. 8(3): 62-68, 1963; Eggli (1994: 223). **Fig. XXIV.e**

[2b] Stems to 30 × 0.7 - 1.5 cm (pendent to 60 cm), sometimes branched basally, young glutinous; **L** scars with 1 **L** trace; **Ros** 7 - 12 cm Ø, with 20 - 35 **L**, these often first clustered, later ± distant, in the uppermost 5 - 11 cm of the stems; **L** obovate to obovate-spatulate or oblanceolate, straight or ± upcurved, 3 - 6.5 × 1.8 - 3.5 cm, 3 - 15 mm thick, green to tinged ± violet, bluish-glaucous-pruinose; lower 5 - 9 cm of **Inf L**-less, above with lanceolate sterile **Bra**, (13-) 18 - 32 cm, rose-coloured, glaucous-pruinose, uppermost 3 - 12 cm with 6 - 20 **Fl**; fertile **Bra** lanceolate, to 14 × 4.5 mm, 2-toothed; **Ped** 4 - 15 mm; **Cal** 10 - 16 × 8 - 13 mm; **Sep** erect, appressed, unequal, 6 - 15 × 3 - 7 mm; **Cl** 2 - 6 mm longer than the **Cal**, 12 - 17 × 12 - 14 mm, red, outside slightly glaucous-pruinose; **Pet** oblong-lanceolate, 3.5 - 5 mm broad, tube 0.5 - 1.5 mm, lobes first erect, later recurved from the middle; **Sc** of the **Pet** 4 - 7.5 mm above the **Cl** base, 1 - 2.5 × 1.25 - 1.5 mm; **Fil** 6 - 10.5 mm, epipetal **Fil** fused with the **Cl** for 2 - 4 mm, basally whitish, above rose-coloured to red; **NSc** 0.5 - 0.6 × 1.5 - 2.3 mm, concave, yellowish-white; **Ca** (almost) free, above divaricate, 7.5 - 9 × 2.25 - 2.5 mm, white or greenish; **Sty** inconspicuously offset, 1.5 - 3 mm, red. – *Cytology*: $n = 33, 66, 99$.

The chromosome number of $n = 88$ cited in the protologue was obviously erroneous, and Uhl & Moran (1973) later only cite the numbers given above.

P. hookeri (Salm-Dyck) A. Berger (NPF2 18a: 483, 1930). **T:** not typified. – **D:** Mexico (Aguascalientes, W San Luis Potosí); rock cliffs, 2000 - 2500 m. **I:** CSJA 62: 236-241, 1990.

≡ *Diotostemon hookeri* Salm-Dyck (1854) ≡ *Echeveria hookeri* (Salm-Dyck) Lemaire (1863); **incl.** *Cotyledon adunca* Baker (1869) ≡ *Echeveria adunca* (Baker) Otto (1873) ≡ *Pachyphytum aduncum* (Baker) Rose (1905); **incl.** *Pachyphytum roseum* hort. ex Baker (1869) (*nom. inval.*, Art. 34.1c); **incl.** *Pachyphytum uniflorum* Rose (1903) ≡ *Echeveria uniflora* (Rose) A. Berger (1912).

[1] Stems $\geq 30 \times 0.8 - 1.7$ cm (decumbent to > 50 cm); **Ros** with (10-) 25 - 40 congested **L** (more distant below) in the uppermost 5 - 17 cm of the stems; **L** lanceolate or oblanceolate to elliptic, fusiform, obscurely terete, $2.5 - 5 \times 0.6 - 1.8$ cm, 5 - 11 mm thick, green or glaucous-pruinose, sometimes reddish; **Inf** with 4 - 9 sterile **Bra**, 5 - 35 cm, rose-coloured to red, uppermost 3 - 14 cm with 4 - 18 laxly arranged **Fl**; fertile **Bra** not overlapping, elliptic, similar to the **L**, $5 - 8 \times 2.5 - 4.5$ mm; **Ped** 4 - 37 mm; **Cal** 4 - $8 \times 5 - 10$ mm, rose-coloured to red or green-tipped; **Sep** erect, triangular-ovate to -lanceolate, pointed, (almost) equal, $3 - 7 \times 2 - 5.5$ mm; **CI** tubular to campanulate, weakly pentagonal, $5.5 - 15 \times 3.5 - 9$ mm, (basally) reddish or towards the base yellowish, rose-coloured or with yellow; **Pet** oblong to oblong-oblanceolate, 3 - 5.5 mm broad, tube 0.2 - 1.5 mm, lobes erect; **Sc** of the **Pet** $\pm 2.5 - 6$ mm above the **CI** base, ± 1 mm; **Fil** 3 - 8 mm, epipetal **Fil** united with the **CI** for 1.5 - 3 mm, yellowish-white; **NSc** $0.3 - 0.6 \times 1 - 2.5$ mm, yellowish-white; **Ca** almost free, $4 - 7 \times 2 - 2.5$ mm, basally whitish, above greenish or yellowish; **Sty** 1 - 2 mm. – *Cytology*: $n = 32, 64, \pm 128, \pm 160$.

P. kimnachii Moran (CSJA 39(6): 204-207, ill., 1967). **T:** Mexico, San Luis Potosí (*Kimnach* 290 [SD, BH, CAS, DS, GH, HNT, K, MEXU, MICH, NY, UC, US]). – **D:** Mexico (San Luis Potosí); moss-covered rocks in pine-oak forests, ± 1800 m, only known from the type locality. **Fig. XXIV.f**

[2b] Stems to $30 \times 1.5 - 2.5$ cm (decumbent to 60 cm), basally branched; **Ros** 15 - 20 cm $\varnothing$, with 12 - 35 **L**, these young congested, later mostly clearly distant, in the uppermost 15 cm of the stems; **L** elliptic-oblong, middle **L** spreading, lower **L** often recurved, $5 - 10 \times 1.7 - 3.5$ cm, 7 - 13 mm thick, glaucous-pruinose, often first $\pm$ violet; lower 5 - 11 cm of the **Inf L**-less, above with 5 - 9 appressed sterile **Bra**, 21 - 48 cm, $\pm$ cherry-red, glaucous-pruinose, old appearing rose-coloured, uppermost 6 - 23 cm with 12 - 28 **Fl**; fertile **Bra** initially overlapping, narrowly ovate, somewhat oblique, acute, 2-toothed and amplexicaul, $18 - 25 \times 8 - 12$ mm, pale green, glaucous-pruinose; **Ped** 3 - $7 \times 2 - 3.5$ mm, apically thicker; **Cal** apically somewhat recurved, $17 - 28 \times 10 - 17$ (basally 8 - 11) mm; **Sep** appressed, unequal, $9 - 28 \times 2.5 - 8$ mm; **CI** penta-

gonal, $12 - 16 \times 7 - 9$ (basally), 6 - 7 (middle), 13 - 17 (above) mm, white or pale rose-coloured; **Pet** triangular-lanceolate, $13 - 17 \times 3 - 4.5$ mm, tube ± 0.5 mm, lobes narrowly acute, obtusely keeled, erect, later somewhat recurved from the middle, apically with irregularly ovate carmine-red spot; **Sc** of the **Pet** 5 - 8 mm above the base of the **CI**, $\pm 1 \times 1.2 - 1.8$ mm, carmine-red; **Fil** 7 - 10 mm, epipetal **Fil** united with the **CI** for ± 3 mm, basally whitish, above carmine-red; **NSc** truncate, ventrally concave, $0.3 - 0.6 \times 1.9 - 2.6$ mm, yellowish; **Ca** almost free, $7 - 9 \times 2 - 3$ mm, basally whitish, above rose-coloured; **Sty** 1.5 - 2 mm, carmine-red or green-tipped. – *Cytology*: $n = \pm 33$.

Distinguished from all other species of Sect. *Pachyphytum* by the longer and more acutely pointed petals. According to the protologue, *P. werdermannii* is the most similar taxon.

P. longifolium Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 12, 1905). **T:** Mexico (*Purpus* s.n. [US, BH, NY, US]). – **D:** Mexico (Hidalgo: region of the Barranca de Metztitlán); steep rocks of the gorge, apparently also epiphytic, ± 1200 m. **I:** Moran (1991).

[2a] Stems to $55 \times 1 - 2.5$ cm (pendent to 70 cm), few-branched from near the base and above; **Ros** with 20 - 60 distinctly distant **L** in the uppermost 5 - 20 cm of the stems; **L** oblanceolate, $6 - 11 \times 1.5 - 2.5$ cm, 4 - 10 mm thick, glaucous-pruinose, often $\pm$ violet; lower 15 - 26 cm of the **Inf L**-less, above with 6 - 9 sterile **Bra**, 15 - 40 cm, glaucous-pruinose, uppermost 4 - 36 cm with 10 - 50 **Fl**; fertile **Bra** first overlapping, $\pm$ obliquely elliptic to obovate, $12 - 22 \times 5 - 12$ mm; **Ped** 3 - 7 mm; **Cal** $11 - 18 \times 10 - 16$ (above) mm; **Sep** unequal, $9 - 17 \times 2.5 - 11$ mm; **CI** pentagonal, apically 8 - 13 mm $\varnothing$, white to rose-coloured; **Pet** rhombic to oblanceolate, $7 - 10 \times 3.5 - 5$ mm, tube $\pm 0.5 - 1.8$ mm, lobes first erect, later ascending-divaricate from the middle, apically with faint round dark red spot; **Sc** of the **Pet** $\pm 4.5 - 6.5$ mm above the base of the **CI**; **Fil** 5 - 8.5 mm, epipetal **Fil** united with the **CI** for 2 - 3 mm, red above; **NSc** $0.9 \times 2 - 2.5$ mm, yellowish; **Ca** $6 - 8 \times 2 - 3$ mm, basally whitish, dark red above; **Sty** ± 2 mm. – *Cytology*: $n = 66$.

According to Moran (1991) most closely related to *P. bracteosum* (with very similar inflorescences and flowers).

P. machucae I. García & al. (Acta Bot. Mex. 47: 10-11, ill., 1999). **T:** Mexico, Michoacán (*García Ruiz* 4497 [IEB, CIMI, ENCB, MEXU]). – **D:** Mexico (Michoacán); rocky slopes in tropical deciduous forest, 1800 - 1850 m.

[1-2a] Perennial **Ros** plants; stems decumbent to pendent, to $30 \times 1.5 - 2.5$ cm, simple or branched; **Ros** compact, 10 - 15 cm $\varnothing$, with 12 - 28 **L**; **L** lanceolate, (4-) $6 (-7.7) \times (1.6-) 1.8 (-2.3)$ cm, to 1.6 cm thick, glaucous grey-lavender tinged yellowish

green towards the base, tip conical-rounded; **Inf** 18 - 30 cm, pale green, tinged pale rose above, with 10 - 20 **Fl**; **Bra** 10 - 22, oblong-elliptic, 5 - 18 × 2 - 5 mm, acute to rounded; floral **Bra** not imbricate; **Ped** 5 - 10 mm; **Sep** appressed to the **Cl** and as long or slightly longer than the **Cl**, ovate to oblong, unequal, 7 - 11 × 3 - 6 mm, tip obtuse to rounded; **Cl** campanulate; **Pet** oblong-oblongate, mucronate, 6 - 8 × 2 - 3 mm, base yellowish-greenish, pale green above, inner face with an oval to subcircular rose to dark red spot in the centre, spot 2.5 - 3 × 2 - 3 mm, floral tube very short, scales ovate-subcircular, rose to dark red; **Fil** ± 6 mm, epipetalous **Fil** fused ± 3.5 mm with the **Cl**; **NSc** ± 0.5 mm, pale yellowish-green; **Ca** ± 5.5 mm, pale green, reddish above; **Sty** pale green.

The long and almost terete leaves point to an affiliation with Sect. *Diotostemon* while most but not all floral characters classify it in Sect. *Pachyphytum*. According to the protologue, *P. machucae* is closest to *P. caesium*. It represents perhaps the most basal species in the genus.

P. oviferum J. A. Purpus (Monatsschr. Kakt.-kunde 29: 100, 1919). **T**: Mexico, San Luis Potosí (*Purpus* s.n. [not located]). – **D**: Mexico (San Luis Potosí); rock cliffs, 1200 m, only known from a single locality. **I**: Moran (1969). **Fig. XXV.a**

[2a] Stems first erect, later decumbent to pendent, to 20 × 0.7 - 1.3 cm; **Ros** 6 - 10 cm Ø, with 12 - 25 strongly congested **L**; **L** obovate to elliptic-obovate, rounded, 3 - 5 × 1.8 - 3 cm, 8 - 17 mm thick, bluish-glaucous-pruinose to lavender-coloured; **Inf** above with 3 - 8 sterile **Bra**, 3 - 12 cm, pale green or reddish, glaucous-pruinose, upper 3 - 7 cm with 7 - 15 **Fl**; fertile **Bra** first overlapping, elliptic-obovate, 12 - 18 × 8 - 15 mm, greenish-white; **Ped** 2 - 5 mm, apically strongly thickened; **Cal** 13 - 23 × 10 - 16 (above) mm; **Sep** unequal, 6 - 20 × 2 - 12 mm; **Cl** apically 10 - 13 mm Ø, inside white; **Pet** oblong, 7 - 10 × 3 - 4.5 mm, tube 0.5 - 1 mm, lobes erect, ascending-divaricate from the middle towards the end of the anthesis, apically with a faint round dark purple-red spot; **Sc** of the **Pet** 4.5 - 6 mm above the **Cl** base, 0.5 - 1.5 mm; **Fil** 5.5 - 7.5 mm, epipetal **Fil** united with the **Cl** for 2 - 3 mm, yellowish-white; **NSc** 1.8 - 2.2 mm broad, yellowish; **Ca** free, 4 - 6 × 1.75 - 2.25 mm, yellowish-green; **Sty** 1 - 1.25 mm. – *Cytology*: *n* = 33.

Most closely related to *P. bracteosum* according to Moran (1969).

P. viride E. Walther (CSJA 8: 210-211, ill., 1937). **T**: Mexico (*Walther* s.n. [CAS 234676]). – **D**: Mexico (Querétaro); shady cliffs, 1820 - 2180 m. **I**: Moran (1992c).

[2b] Stems to 50 × 1.5 - 3.5 cm (decumbent or pendent to > 1 m), basally few-branched; **Ros** with 12 - 40 **L** in the uppermost 3 - 12 cm of the stems,

more distant below; **L** elliptic-oblong, terete, basally abruptly narrowed, widely spreading, somewhat upcurved, 6 - 10 × 1.5 - 3 cm, 10 - 17 mm thick, pale to dark green or ± violet-red, not glaucous-pruinose; lower 10 - 17 cm of the **Inf** **L**-less, above with 6 - 9 appressed caducous sterile **Bra**, 10 - 35 cm, pale green to intensely violet-red, uppermost 5 - 12 cm with 10 - 22 **Fl**, strongly arching until after flowering; fertile **Bra** first overlapping, ovate to obovate or somewhat rhombic, lower **Bra** 15 - 30 × 7 - 18 mm, pale green or rose-coloured; **Ped** 2 - 6 (-8) mm; **Cal** 13 - 25 × 6 - 13 mm; **Sep** erect, appressed, unequal, 10 - 19 × 3 - 9 mm; **Cl** 9 - 14 × 6 - 13 mm, hidden between the **Sep**, white; **Pet** oblong-oblongate, 8 - 14 × 2.5 - 6 mm, tube ± 0.5 mm, lobes erect, acute, ascending-spreading from the middle, towards the tip with faint round to ovate dark purple-red spot; **Sc** of the **Pet** 4 - 7 mm above the **Cl** base, red; **Fil** 4 - 8 mm, epipetal **Fil** united with the **Cl** for 2 - 3 mm, basally yellowish, red above; **NSc** obliquely truncate, 2 - 3 mm broad, yellowish; **Ca** 4.5 - 8 × 1 - 1.5 mm, basally white, red above; **Sty** ± 1 mm, green-tipped. – *Cytology*: *n* = 33.

The largest species of the genus and distinguished from all others by thicker stems and larger leaves and bracts (Moran 1992c).

P. werdermannii von Poellnitz (RSN 42: 2, 1937). **T**: Mexico, Tamaulipas (*Werdermann* s.n. [B [photo]]). – **Lit**: Moran (1967: with ill.). **D**: Mexico (Tamaulipas); steep slopes, 600 - 700 m, only known from 1 locality. **Fig. XXIV.h, XXV.b**

[2b] Stems to 20 × 0.6 - 1.4 cm (pendent to 1 m), basally branched; **Ros** with 10 - 35 rather distant **L** in the uppermost 5 - 16 cm of the stems; **L** elliptic to oblong, obtuse to narrowly rounded, rarely delicately mucronate, 4 - 10 × 1.5 - 3.5 cm, 5 - 12 mm thick, glaucous-pruinose; **Inf** above with 6 - 9 sterile **Bra**, 15 - 25 cm, pale green, glaucous-pruinose, uppermost 5 - 11 cm with 10 - 22 **Fl**; fertile **Bra** first overlapping, elliptic, shape as the lower **Bra**, 15 - 20 × 7 - 10 mm; **Ped** 3 - 8 (-15) mm; **Cal** 12 - 20 × 9 - 12 mm; **Sep** unequal, 10 - 19 × 2.5 - 8 mm; **Cl** 10 - 13 × 9 - 14 (apically) mm, pale rose-coloured; **Pet** oblong, 3 - 4 mm broad, tube 0.5 mm, lobes acute, tips first overlapping, later ascending from near the middle, towards the tip with dark carmine-red spot; **Sc** of the **Pet** 5 - 8 mm above the **Cl** base, to 1 mm, carmine-red; **Fil** 6 - 9 mm, epipetal **Fil** fused with the **Cl** for 3 - 3.5 mm, basally whitish, above reddish; **NSc** 1.5 - 2 mm broad, yellowish; **Ca** 5 - 7 mm, basally whitish, red above; **Sty** 1 - 1.5 mm. – *Cytology*: *n* = 33.

The species was recollected in 1966 by Moran (l.c.).

×PACHYSEDUM

U. Eggli

×**Pachysedum** G. D. Rowley (Nation. Cact. Succ. J. 28(1): 7, 1973).

= *Pachyphytum* × *Sedum*. Jacobsen (1981) lists a single cultivar.

×PACHYVERIA

U. Eggli

×**Pachyveria** Haage & Schmidt (Haupt-Verzeichnis 193, [], 1926). – **Lit:** Walther (1934).

Incl. ×*Pachyrrantia* E. Walther.

Incl. ×*Echephytum* Gossot (1938).

Incl. ×*Urbiphytum* Gossot (1938).

= *Pachyphytum* × *Echeveria*. About half a dozen taxa and cultivars have been named.

The following names are of unresolved application but are referred to this genus: *Echeveria bergeriana* Cat. Haage ex E. Walther (1934) (*nom. inval.*, Art. 34.1c); *Echeveria brachyantha* Sprague (1926); *Echeveria ×clavifolia* A. Berger (1904); *Echeveria ×fusifera* Hort. Haage ex E. Walther (1934) (*nom. inval.*, Art. 34.1c); *Echeveria ×mirabilis* Hort. Deleuil ex von Poellnitz (1936); *Echeveria ×morreniana* Hort. Deleuil ex von Poellnitz (1936); *Echeveria nobilis* hort. ex von Poellnitz (1936) (*nom. inval.*, Art. 34.1c); *Echeveria ×pachyphytoides* De Smet (1874) = *Pachyphytum ×pachyphytoides* (De Smet) A. Berger (1930) = ×*Pachyveria pachyphytoides* (De Smet) E. Walther (1934); *Echeveria ×paradoxa* Gossot (1938) = ×*Echephytum paradoxum* (Gossot) H. Jacobsen (1954) (*nom. inval.*, Art. 33.2) = ×*Pachyveria paradoxa* (Gossot) G. D. Rowley (1955); *Echeveria ×scheideckeri* De Smet (1877) = ×*Pachyveria scheideckeri* (De Smet) E. Walther (1934); *Echeveria ×sobrina* A. Berger (1904) = ×*Pachyveria sobrina* (A. Berger) E. Walther (1934); *Echeveria ×sodalis* A. Berger (1904) = *Pachyphytum ×sodale* (A. Berger) Rose (1905) = ×*Pachyveria sodalis* (A. Berger) E. Walther (1934); *Echeveria ×spathulata* Morren ex von Poellnitz (1936); *Echeveria valida* Haage & Schmidt (1883); ×*Pachyveria bergeriana* Hort. Haage ex E. Walther (1934); ×*Pachyveria clavata* E. Walther (1934); ×*Pachyveria clavata* var. *cristata* E. Walther (1934); *Pachyveria clevelandii* Hort. Haage ex E. Walther (1934); ×*Pachyveria glauca* Hort. Haage & Schmidt ex E. Walther (1934); ×*Pachyveria mirabilis* Hort. Deleuil ex E. Walther (1934); ×*Pachyveria morreniana* Hort. Deleuil ex E. Walther (1934); ×*Pachyveria scheideckeri* var. *albocarinata* E. Walther (1934) (*nom. inval.*, Art. 32.1c); ×*Pachyveria spathulata* Morren ex E. Walther (1934).

PERRIEROSEDUM

H. Ohba

Perrierosedum (A. Berger) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12(4): 166, 1978). **T:** *Sedum madagascariense* H. Perrier. – **D:** Madagascar. **Etym:** For J. M. Henri A. Perrier de la Bâthie (1873 - 1958), French botanist, lived in Madagascar 1896 - 1933; and for the similarity to the genus *Sedum* (Crassulaceae).

= *Sedum* Sect. *Perrierosedum* A. Berger (1930).

Perennial shrublets 50 - 80 cm tall, branched; **Br** glabrous, 4-angled; **L** opposite, oblong-spatulate, 2.5 - 5 × 1.5 - 2.5 cm, sessile, tip rounded, base long attenuate, margin crenulate; **Inf** terminal, corymbose-cymose, 5- to 10-flowered, 2 - 3 × 3 - 4 cm, pedunculate, bracteate; **Fl** hermaphrodite, obdiplostemonous, 6- (rarely 5-) merous; **Ped** 8 - 10 mm; **Sep** free, ovate, tip round, 4 - 5 mm; **Pet** free, white tinged with red, broadly spatulate, convex, 5-veined, 8 - 10 mm, tip round; **St** 6 - 7 mm, erect; **NSc** oblong, 3 - 3.5 mm, tip bifid; **Ca** free, 8.5 - 10 mm, attenuate towards base, ventrally straight, tapering towards the tips, ovules ± 30 in each follicle; **Se** cylindrical, testa longitudinally striate.

A monotypic genus without close allies in the family and not recently recollected in the wild nor known to be in cultivation.

P. madagascariense (H. Perrier) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12(4): 166, 1978). **T:** Madagascar (*Perrier* s.n. [P]). – **D:** Madagascar (Andringitra Massif).

= *Sedum madagascariense* H. Perrier (1922).

Description as for the genus.

PHEDIMUS

H. 't Hart & B. Bleij

Phedimus Rafinesque (Amer. Monthly Mag. & Crit. Rev. 1: 438, 1817). **T:** *Sedum stellatum* Linné [Lectotype, designated by 't Hart, Fl. Medit. 1: 52, 1991.]. – **Lit:** Praeger (1921a: as *Sedum*); Grulich (1984: as *Asterosedum*); 't Hart (1995); Ohba & al. (2000). **D:** Europe, Asia. **Etym:** From Gr. 'phaidimos', shining; perhaps for the leaves of some species; or for Phedimus (fl. 235), archbishop at Amasea and Metropolitan of Pontus (in present-day Turkey), for the distribution of some taxa.

Incl. *Aizopsis* Grulich (1984). **T:** *Sedum aizoon* Linné.

Incl. *Asterosedum* Grulich (1984). **T:** *Sedum stellatum* Linné.

Incl. *Spathulata* (A. Borissova) A. Löve & D. Löve (1985). **T:** *Sedum spurium* S. G. Gmelin.

Perennial or rarely annual herbs, usually glabrous, sometimes stems woody at the base or with a woody rhizome; **L** opposite or alternate, flat, usually dentate or serrate with several hydathodes on

the lower face along the margin; flowering **Br** erect or ascending; **Inf** usually dense many-flowered cymes or corymbs; **Bra** L-like but smaller than the **L**; **Fl** (4- to) 5- to 6- (to 7-) merous, obdiplostemonous, sessile, subsessile or shortly pedicellate, subtended by 1 **Bra** each; **Sep** broadly sessile, usually unequal, green, oblong to linear; **Pet** basally free, usually spreading, white, pink, red to purplish or yellow; **Fr** follicles, usually spreading with distinct lips along the ventral suture, rarely erect; **Se** ovoid, 1 - 1.4 mm, brown, costate or multipapillate.

Traditionally, the species of *Phedimus* have been included in *Sedum*. They form a conspicuous element within this genus because of their flat, usually serrate or dentate leaves with several marginal hydathodes. They share these vegetative characters with *Hylotelephium* and *Rhodiola* and, consequently, 't Hart (1982) placed these taxa in the informal group of Asian flat-leaved *Sedoideae*. Chloroplast DNA analyses (see Ham (1994) and 't Hart (1995)) indicate that the 3 genera mentioned, together with *Orostachys* (incl. *Meterostachys*), *Pseudosedum*, *Sinocrassula* and *Umbilicus*, form a distinct lineage which is a sister group (subtribe *Telephiinae*) to *Sedum* proper (subtribe *Sedinae*). In particular, DNA sequence analyses indicate that within this clade the Asian and Eurasian species of *Phedimus* form a monophyletic lineage.

Within the *Phedimus* lineage, 2 distinct groups can be distinguished which differ in several vegetative as well as floral characters and agree with *Sedum* Ser. *Propontica* A. Berger ('t Hart 1991) and *Sedum* Sect. *Aizoon* Maximowicz, respectively. They have been classified as subgenera within *Phedimus* ('t Hart 1995):

- [1] Subgen. *Phedimus*: Perennial or annual herbs with creeping and rooting or erect stems, sometimes papillose; **L** opposite, circular to oblong or spatulate or pseudopetiolate; **Inf** dense cymes to lax cymes with 2 - 3 simple **Br**; **Pet** spreading or erect during anthesis, white, pink, red or purplish; **Anth** red; **Fr** stellately patent or (sub-) erect; **Se** costate. – *Cytology*: $x = 5, 6, 7$. Species from Eurasia (C and E Mediterranean region, Anatolia, Caucasus and N Iran).
- [2] Subgen. *Aizoon* (Koch) 't Hart 1995: Perennial, glabrous or pubescent (hirsute) herbs with usually erect or ascending annual shoots, often woody at the base, emerging from a woody rhizome; **L** alternate or opposite, linear-lanceolate or oblong to rhombic; **Inf** cymes with 3 - 5 sometimes forked cincinni; **Pet** spreading, yellow; **Fil** yellow; **Anth** yellow or reddish; **Fr** spreading with distinct lips along the suture; **Se** multipapillate or costate. – *Cytology*: $x = 8$. Species from E Asia (China, Japan, Korea to C Siberia).

Subgen. *Phedimus* contains 5 distinct species, which are quite well understood. The decussate

leaves and white, pink or red flowers are distinctive characters. The geographical distribution of the group is largely contiguous indicating a recent origin. The group is mainly diploid (except for *P. spurius*) with a simple descending dysploid series of $x = 7$ to $x = 6$ and $x = 5$ ('t Hart & al. 1993b).

Subgen. *Aizoon* is also a very distinct taxon and morphologically and cytologically equally well-defined, but its component species are much less clear. The hirsute *P. selskianum* stands out clearly, but the other taxa are difficult to separate and seem to merge because of the uniformity of floral characters and the extreme variation of vegetative characters. Fröderström (1931) included all species, either as subspecies or as synonyms, in *P. aizoon* (= *Sedum aizoon*), except for *P. hybridus* (= *Sedum hybridum*). In this account we follow a less rigorous and much more conservative course. However, large-scale comprehensive biosystematic studies of natural populations (see e.g. Amano (1990) and Amano & Ohba (1992)) are needed before we can properly understand the confusing morphological and cytological variation within this group. Many species have been in cultivation since the early 17th century (no doubt adding considerably to the taxonomic confusion) and some have become naturalized outside their natural ranges.

Acknowledgment: We wish to thank Dr. Jeong Hee Kim for her critical advice on *Phedimus* Subgen. *Aizoon*.

The following name is of unresolved application but is referred to this genus: *Sedum pseudohybridum* Woroshilov & Shlothauer (1984).

P. aizoon (Linné) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). **T**: LINN. – **Lit**: Ohba & al. (2000). **D**: Russia (Siberia, and E of the Ural Mts.), Mongolia, China, Japan; dry sites, grassy slopes, shrub thickets, meadows, rocky streambanks and sandy cliffs; naturalized in N Europe and the Baltic countries. **I**: Praeger (1921a: 109-110).

≡ *Sedum aizoon* Linné (1753) ≡ *Aizopsis aizoon* (Linné) Grulich (1984); **incl.** *Sedum aizoon* var. *aurantiacum* hort. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sedum aizoides* Salm-Dyck (1834); **incl.** *Sedum sajanense* Pallas ex Ledebour (1843); **incl.** *Sedum aizoon* var. *latifolium* Maximowicz (1859) ≡ *Sedum aizoon* fa. *latifolium* (Maximowicz) Y. C. Zhu (1989) ≡ *Phedimus aizoon* var. *latifolius* (Maximowicz) H. Ohba & al. (2000); **incl.** *Sedum aizoon* fa. *floribundum* Miquel (1866); **incl.** *Sedum maximowiczii* Regel (1866) ≡ *Phedimus maximowiczii* (Regel) 't Hart (1995) ≡ *Aizopsis maximowiczii* (Regel) S. Gontcharova (1999); **incl.** *Sedum pseudo-aizoon* Debeaux (1877); **incl.** *Sedum yantaiense* Debeaux (1877); **incl.** *Sedum aizoon* fa. *angustifolium* Franchet (1883) ≡ *Sedum aizoon* var. *angustifolium* (Franchet) Chu (1959); **incl.** *Sedum aizoon*

var. *scabrum* Maximowicz (1884) $\equiv$ *Phedimus aizoon* var. *scabrum* (Maximowicz) H. Ohba & al. (2000); **incl.** *Sedum aizoon* var. *floribundum* Nakai (1911) $\equiv$ *Phedimus aizoon* var. *floribundus* (Nakai) H. Ohba (2001); **incl.** *Sedum aizoon* var. *saxatilis* Nakai (1911); **incl.** *Sedum woodwardii* N. E. Brown (1912); **incl.** *Sedum hyperaizoon* Komarov (1931); **incl.** *Sedum austro-manshuricum* Nakai & Kitagawa (1934) $\equiv$ *Sedum aizoon* var. *austro-manshuricum* (Nakai & Kitagawa) Kitagawa (1939); **incl.** *Sedum aizoon* var. *obovatum* Fröderström (1935); **incl.** *Sedum selskianum* var. *glaberrimum* Kitagawa (1936) $\equiv$ *Sedum aizoon* fa. *glaberrimum* (Kitagawa) Kitagawa (1939); **incl.** *Sedum selskianum* var. *glabrifolium* Kitagawa (1936) $\equiv$ *Sedum aizoon* var. *glabrifolium* (Kitagawa) Kitagawa (1939) $\equiv$ *Sedum aizoon* fa. *glabrifolium* (Kitagawa) Y. C. Zhu (1989); **incl.** *Sedum aizoon* var. *yamatutae* Kitagawa (1939) $\equiv$ *Phedimus aizoon* var. *yamatutae* (Kitagawa) H. Ohba & al. (2000); **incl.** *Sedum aizoon* var. *heterodontum* Nakai (1949) (*nom. inval.*, Art. 32.1c); **incl.** *Sedum aizoon* var. *ramosum* Uyeki & Sakata (1949) (*nom. inval.*, Art. 32.1c); **incl.** *Sedum kamtschaticum* fa. *viviparum* Takejiri Hashimoto (1975); **incl.** *Sedum hsinganicum* Y. C. Chu ex S. H. Fu & Y. H. Huang (1980) $\equiv$ *Phedimus hsinganicus* (Y. C. Chu ex S. H. Fu & Y. H. Huang) H. Ohba & al. (2000); **incl.** *Sedum aizoon* ssp. *baicalense* Peschkova (1994).

[2] Perennial robust glabrous herbs with a large thick torulose and woody **R**stock and erect stems to 80 cm long; **L** broadly ovate to narrowly oblanceolate or linear-lanceolate, (1-) 5 - 9 cm, obtuse, dentate to almost entire, glabrous or sometimes scabrid-papillose, short-petiolate; **Inf** terminal, 2.5 - 7.5 cm $\varnothing$, flat; **Fl** 5- to 6-merous, sessile; **Sep** linear to lanceolate, obtuse, 3.5 - 6 mm; **Pet** connate for up to 2 mm, oblong, rather long-mucronate, 7 - 9 mm, bright yellow; **Anth** yellow; **NSc** square or broader than long, white; **Fr** connate for up to 3 mm, many-seeded, 7 - 8 mm, yellow, often becoming orange or red. – *Cytology*: $2n = 32, 33, 34, 48, 61, 64, 78, 80, 84, 85, 88, 93, 94, 95, 96, 97, 102$ (Amano 1990); $2n = 71-124$ (Amano & Ohba 1992).

Ohba (1982b), Amano (1990) and Amano & Ohba (1992) distinguish 2 subspecies in Japan, ssp. *aizoon* and ssp. *floribundum*. They are separated by a small number of quantitative vegetative characters. Ssp. *aizoon* is larger and more uniform in all characters, whereas ssp. *floribundum* is generally smaller and comprises several morphologically distinct geographical races. Cytologically both taxa are extremely variable. The differences in chromosome numbers agree with the morphological variation to some extent. The larger ssp. *aizoon* is highly polyploid comprising an aneuploid series with 37 different chromosome numbers ranging from $2n = 71$ to $2n = 124$ (with $2n = 96$ most frequent), whereas the smaller ssp. *floribundum* is tetraploid ($2n = 32$), hexaploid ($2n = 48$), or octoploid ($2n = 64$).

According to Fu (1980) *Sedum hsinganicum* is similar to *S. aizoon* var. *latifolium*, but differs by its 8-merous flowers and opposite leaves. The alleged floral characters, however, are largely at odds with an assignment of this taxon to *Phedimus* Subgen. *Aizoon*. As yet we have no clue to the proper systematic position of this questionable species. It is without comment recognized as a separate species and at the same time placed in *Phedimus* by Ohba & al. (2000). The same authors recognize 3 varieties for their treatment of *P. aizoon* for the Flora of China.

P. ellacombianus (Praeger) 't Hart (in 't Hart & Egli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). – **D**: Japan, Korea; long cultivated in Europe and N America. **I**: Praeger (1921a: 118-119, as *Sedum*).

$\equiv$ *Sedum ellacombianum* Praeger (1917) $\equiv$ *Sedum kamtschaticum* ssp. *ellacombianum* (Praeger) R. T. Clausen (1946) $\equiv$ *Aizopsis ellacombianus* (Praeger) P. V. Heath (2001); **incl.** *Sedum latiovalifolium* Y. Lee (1992).

[2] Glabrous decumbent or prostrate herbs, forming compact $\pm$ hemispherical tufts $\pm$ 15 cm high; **L** alternate or decussate, obovate to spatulate, shortly petiolate, crenate-serrate in the upper part, flat, fleshy, to 4×2 cm, obtuse, bright green; flowering **Br** numerous, glabrous, simple, spreading, 10 - 15 cm, reddish below; **Inf** compact leafy flat corymbs 4 cm $\varnothing$; **Fl** (sub-) sessile; **Sep** obtuse, linear, $\frac{1}{2}$ as long as the **Pet**, green; **Pet** lanceolate, acute, carinate, bright yellow; **Fil** spreading, slightly shorter than the **Pet**, yellow; **Anth** yellow; **NSc** whitish, square; **Se** costate or multipapillate.

The recently described *Sedum latiovalifolium* is tentatively placed in the synonymy here. It is said to differ from *P. ellacombianus* by the broadly ovate leaves arranged in rosettes. – [H. 't Hart, B. Bleij & U. Egli]

P. floriferus (Praeger) 't Hart (in 't Hart & Egli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). – **D**: NE China. **I**: Praeger (1921a: 123, as *Sedum*).

$\equiv$ *Sedum floriferum* Praeger (1918) $\equiv$ *Sedum kamtschaticum* var. *floriferum* (Praeger) R. Stephenson (1994) (*nom. inval.*, Art. 33.2) $\equiv$ *Aizopsis florifera* (Praeger) P. V. Heath (2001).

[2] Glabrous herbs with a woody torulose **R**stock and thick **R**; **L** spatulate-oblanceolate, obtuse, crenate in the upper part, sessile, to $4 \times \pm 1.5$ cm, dark green; flowering **Br** ascending or decumbent, somewhat scabrid, to 15 cm long, often richly branched in the upper part, with spreading axillary **Br**, red; **Inf** terminal or lateral, flattish, 2 - 5 cm $\varnothing$; **Fl** subsessile; **Sep** basally free or slightly connate, widely spreading, linear to oblanceolate, obtuse, very fleshy, $\frac{1}{2}$ as long as the **Pet**; **Pet** lanceolate, acute, short-mucronate, greenish-yellow; **Fil** greenish; **Anth** reddish-yellow; **NSc** small, square, entire, greenish, translucent; **Sty** long, slender, erect, min-

utely capitate; **Fr** equal to or somewhat shorter than the **Fil**, greenish-yellow.

Probably described from cultivated material, but apparently no longer in cultivation (Stephenson 1994). Its status within Subgen. *Aizoon* is uncertain. Although it is treated explicitly as a species in the Chinese Flora, it is not mentioned by Chung & Kim (1989).

P. hybridus (Linné) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). **T**: LINN?. – **Lit**: J alas & al. (1999: 80-81 [distribution map]). **D**: Russia (E and C Siberia to the S and C Ural Mts.), C Asia; stony and gravelly soils, rock crevices, predominantly in mountain steppes, less often in the S part of the forest zone; naturalized in N Europe. **I**: Praeger (1921a: 126, as *Sedum*).

Incl. *Sedum hybridum* var. *dentatum* hort. (s.a.); $\equiv$ *Sedum hybridum* Linné (1753) $\equiv$ *Anacampseros hybrida* (Linné) Haworth (1819) $\equiv$ *Aizopsis hybrida* (Linné) Grulich (1984); **incl.** *Sedum hohenackeri* Gandoger (1886) (*nom. inval.*, Art. 24.1); **incl.** *Sedum vagans* Gandoger (1886) (*nom. inval.*, Art. 24.1); **incl.** *Sedum sibericum* E. H. L. Krause (1902); **incl.** *Sedum sibiricum* E. H. L. Krause (1902) (*nom. illeg.*, Art. 52.1).

[2] Tufted herbs with a thick and woody **Rstock** and short decumbent hibernating sterile stems with crowded **L** at the tip; **L** obovate to oblong-cuneate or spatulate, obtuse, reddish-dentate towards tip, petiolate with a petiole as long as the lamina, 10 - 40 (-50) $\times$ 8 - 20 mm; flowering **Br** ascending, 10 - 30 cm, with smaller more remote **L**; **Inf** terminal lax (dense according to Fröderström (1932) and Borissova (1939)) corymbs; **Sep** basally connate, lanceolate, obtuse, mamillate in the upper part, 6 - 8 mm; **Pet** connate for up to 2 mm, acute, short-mucronate, 6 - 10 $\times$ $\pm$ 1.5 mm, (golden-) yellow; **Fil** slightly shorter than the **Pet**, yellow; **Anth** orange; **NSc** square or broader than high, slightly emarginate, greenish with a reddish edge; **Sty** long, filiform, pale green or red; **Fr** connate for up to 2.5 mm, many-seeded, 8 - 10 mm; **Se** elliptic, obtuse, < 1 mm.

Probably described from cultivated material. Its status within Subgen. *Aizoon* is uncertain. *Sedum pseudohybridum* Voroschilov & Schlothgauer 1984 was described from the Amur-District, and is, to judge from the epithet, similar to this taxon. Its poor description does not allow an interpretation and it is therefore treated as unresolved.

P. kamtschaticus (Fischer & C. A. Meyer) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). **T**: LE. – **D**: Russia (NE Siberia), N, C and E China, Japan, Korea; stony slopes. **I**: Praeger (1921a: 121, as *Sedum*). **Fig.** XXV.c, XXV.e

$\equiv$ *Sedum kamtschaticum* Fischer & C. A. Meyer (1841) $\equiv$ *Sedum aizoon* ssp. *kamtschaticum* (Fischer

& C. A. Meyer) Fröderström (1929) $\equiv$ *Aizopsis kamtschatica* (Fischer & C. A. Meyer) Grulich (1984); **incl.** *Sedum kamtschaticum* fa. *variegatum* Praeger (1921); **incl.** *Sedum kamtschaticum* fa. *angustifolium* Komarov (1929); **incl.** *Sedum kurilense* Voroschilov (1965) $\equiv$ *Sedum sikokianum* ssp. *kurilense* (Voroschilov) Voroschilov (1985) $\equiv$ *Aizopsis kurilensis* (Voroschilov) S. Gontcharova (1999).

[2] Glabrous herbs with a strong and woody rhizome and numerous spreading-ascending stems; **L** alternate, broadly ovate to narrowly oblanceolate or linear-lanceolate, spatulate or rhombic, obtuse, usually dentate, glabrous, shortly petiolate, 3.5 - 5 (-7) mm long, dark green; flowering **Br** 7 - 25 (-40) cm; **Inf** terminal, flattish, with (1-) 3 (-5) cincinni; **Bra** small, lanceolate, entire; **Fl** 5- to 6-merous, (sub-) sessile; **Sep** linear to lanceolate or ovate, obtuse, to 4.5 mm; **Pet** connate for up to 2 mm, oblong to lanceolate, apiculate or rather long-mucronate, carinate, 7 - 9 mm, yellow; **Fil** nearly as long as the **Pet**, yellow; **Anth** orange; **NSc** square or broader than long; **Sty** reddening after anthesis; **Fr** connate for up to 2 mm, many-seeded, bright red to brown; **Se** dingy brown-yellow. – *Cytology*: $2n = 32, 48, 48 - 64, 64, 80, 96, 112, 128$.

The status of this taxon within Subgen. *Aizoon* is uncertain, but it is in general treated as a distinct species, e.g. by Ohba (1982b), Ohwi & Kitagawa (1983) and Fu & Fu (1984). Fröderström (1931) included *P. ellacombianus* and *P. floriferus* in *P. kamtschaticus*, but this does not really help to clarify the relationships within the group. Praeger (1921a) described a variegated cultivar as fa. *variegatum*.

P. litoralis (Komarov) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). **T**: Russia (*Grischko* s.n. [LE]). – **D**: E Russia (endemic on Popov Island off the coast at Wladiwostok); sandy shores.

$\equiv$ *Sedum litorale* Komarov (1932) $\equiv$ *Aizopsis litoralis* (Komarov) P. V. Heath (2001).

[2] Glabrous herbs with an elongated creeping simple rhizome and strong stems; **L** in whorls of 3 or opposite, the upper ones early deciduous, ovate or obovate-lanceolate, (sub-) obtuse, sessile, 4 - 6 $\times$ 1.8 - 3.5 cm, broadly serrate-dentate with uncinat adjacent teeth, green with small white dots on the surface; flowering **Br** slightly flexuose, lustrous, glabrous, to 32 cm; **Fl** sessile or subsessile; **Sep** triangular, thickened, whitish; **Pet** lanceolate, acute, $\pm$ 4 mm, golden-yellow; **Sty** long, widely spreading; **Fr** rounded dorsally, keeled ventrally.

This taxon was recently regarded as synonym of *P. maximowiczii* (Gontcharova 2000: 126, as *Aizopsis*), which is here treated as synonym of *P. aizoon*.

P. middendorffianus (Maximowicz) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 168-

169, 1995). **T:** Russia (*Anonymus* s.n. [LE]). – **D:** Russia (E Siberia to the Ochotsk coast), China, Japan, N Korea; rock crevices and stony soils in forests. **I:** Praeger (1921a: 116, as *Sedum*).

≡ *Sedum middendorffianum* Maximowicz (1859) ≡ *Sedum aizoon* ssp. *middendorffianum* (Maximowicz) Fröderström (1931) ≡ *Sedum kamtschaticum* ssp. *middendorffianum* (Maximowicz) R. T. Clausen (1946) ≡ *Aizopsis middendorffiana* (Maximowicz) Grulich (1984); **incl.** *Sedum hybridum* Trautvetter & C. A. Meyer (1856) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum middendorffianum* var. *diffusum* Praeger (1921) ≡ *Sedum middendorffianum* cv. *Diffusum* (s.a.); **incl.** *Sedum middendorffianum* ssp. *arcuatum* Voroshilov & Shlothauer (1984).

[2] Glabrous herbs with creeping woody branching rhizomes and numerous, straight, persistent, suberect, short, leafy stems arising from the base of old stems, flowering in late summer; **L** alternate, spreading, linear to linear-lanceolate or linearly spatulate, lower **L** more spatulate, (sub-) obtuse, obtusely crenate to deeply dentate in the upper part, canaliculate, concave, fleshy, to 40 × 4 - 7 mm; flowering **Br** 10 - 30 cm; **Inf** rather laxly paniculate-corymbiform, often with elongated many-flowered **Br**; **Fl** 5-merous, (sub-) sessile; **Sep** linear, (sub-) obtuse, spreading, 2.5 - 4 mm; **Pet** connate for up to 2 mm, lanceolate to linear-lanceolate, acuminate, carinate, 5 - 6 mm, bright yellow; **Fil** to 3 mm, yellow; **Anth** orange; **NSc** small, very short, whitish; **Fr** widely divergent, to 4 mm, with a very short beak, red; **Se** ovoid, small.

The position of this variable species within Subgen. *Aizoon* is uncertain. Praeger (1921a) described a variety which differs mainly in the width and dentation of the leaves.

P. obtusifolius (C. A. Meyer) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). **T:** Azerbaidzhan (*Meyer* s.n. [LE]). – **D:** Iran (Talış), Azerbaidzhan (E Caucasus), Armenia, E Turkey (Anatolia); usually dry places at high altitudes to 2160 m. **I:** Fröderström (1931: 85, t. 29, 52, as *Sedum*).

≡ *Sedum obtusifolium* C. A. Meyer (1831) ≡ *Asterosedum obtusifolium* (C. A. Meyer) Grulich (1984); **incl.** *Sedum caricense* Jaubert & Spach (1842); **incl.** *Sedum listoniae* Visiani (1842) ≡ *Sedum obtusifolium* var. *listoniae* (Visiani) Fröderström (1932); **incl.** *Sedum anatolicum* K. Koch (1847); **incl.** *Sedum millii* Baker (1875); **incl.** *Sedum proponticum* Aznavour (1897); **incl.** *Sedum rhodanthum* Bornmüller (1899) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum bornmuelleri* Haussknecht (1905); **incl.** *Sedum gemmiferum* Woronow ex Tchelkovnikov (1907).

[1] Perennial glabrous herbs, sometimes papillose in the upper part with the sterile shoots at first subterranean, forming short, almost globular, bulb-like propagules of densely packed small white **L** which

produce very flat, above-ground, green **Ros** in autumn; **L** opposite, sessile, spatulate-oblong to oblong to ovate or obovate, acute, obscurely crenate to entire, 2 - 40 × up to 15 mm; flowering **Br** erect, glabrous or papillose above, 6 - 25 (-40) cm; **Inf** subcorymbose, with 2 - 3 (-4) usually simple cincinni; **Bra** small, oblong; **Fl** 5-merous, (sub-) sessile; **Sep** oblong to broadly oblong, (sub-) acute, slightly unequal, often mamillate towards tip, 3 - 6 mm; **Pet** broadly lanceolate to oblong, long-mucronate, 6 - 10 mm, white, pink to reddish-purple; **Fil** 3 - 6 mm, white to red; **Anth** red; **NSc** 0.3 × 0.9 mm; **Fr** basally connate for up to 0.5 mm, stellately patent with distinct lips along the sutures, minutely mamillate, 4- to 10-seeded. – *Cytology*: 2n = 12, 30.

A very variable species in respect to the size of stems, leaves and inflorescences. In the limited Turkish plant material studied so far, the morphological variation seems to be correlated with cytogeographical differences. Diploid (2n = 12) plants appear to be restricted to S and E Anatolia (E of the Anatolian Diagonal), whereas the polyploids (2n = 30) occur in W and C Anatolia (W of the Anatolian Diagonal). The diploids are more slender with smaller leaves, whereas the polyploid plants appear to be more robust, with longer stems and larger leaves and inflorescences. These polyploids seem to agree with Fröderström's var. *listoniae* but we are hesitant to adopt this classification until a more thorough study of the variation of this species has been completed.

P. odontophyllus (Fröderström) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 169, 1995). **T:** China, Sichuan (*Hummel* 3078a [S]). – **D:** China (Sichuan); 300 m. **I:** Fröderström (1932: 118, t. 67-68, as *Sedum*).

≡ *Sedum odontophyllum* Fröderström (1932) ≡ *Aizopsis odontophylla* (Fröderström) Grulich (1984).

[2] Glabrous herbs with thick stoloniferous **R** and ascending, rather stout, basally rooting stems to 20 cm; **L** opposite to alternate, oblong to almost orbicular, subacute to obtuse, sparsely irregularly dentate, long-petiolate, 20 - 40 mm; **Inf** corymbose with 2 or 3 forked cincinni; **Fl** 5- to 6-merous; **Sep** ± equal, broadly linear, obtuse, 2 - 2.5 mm; **Pet** basally slightly connate, oblong to subovate, long-mucronate, 5 - 7 mm, yellow; **Fil** to 4.5 mm; **NSc** (sub-) quadrate, emarginate, 0.5 × 0.6 mm; **Fr** basally slightly connate, stellately patent, many-seeded, to 4 mm; **Se** probably costate.

Fröderström (1932) considered this species to be related to *Sedum* Ser. *Bracteata* and in particular to *S. engleri*. However, the broadly sessile sepals, albeit of equal length, the dentate leaves and the rhizome all indicate that its affinities are with *Phedimus* rather than *Sedum* (Fu & Fu 1984).

P. selskianus (Regel & Maack) 't Hart (in 't Hart &

Eggli (eds.), *Evol. Syst. Crassulaceae*, 169, 1995). **T:** Russia (*Anonymus* s.n. [LE]). – **D:** Russia (E Siberia: Amur Region), Turkestan?, NE China (Manchuria), Japan; dry rocky and stony slopes, deciduous forests and fields. **I:** Praeger (1921a: 114); Fröderström (1931: 81, t. 48:2); both as *Sedum*.

≡ *Sedum selskianum* Regel & Maack (1861) ≡ *Sedum aizoon* ssp. *selskianum* (Regel & Maack) Fröderström (1931) ≡ *Aizopsis selskiana* (Regel & Maack) Grulich (1984); **incl.** *Sedum selskianum* var. *grandiflorum* Bar. & Skv. ex S. H. Fu (1984) (*nom. inval.*, Art. 36.1); **incl.** *Sedum selskianum* var. *latifolium* Bar. & Skv. ex S. H. Fu (1984) (*nom. inval.*, Art. 36.1).

[2] Pubescent herbs with few erect hairy stems and a thick and woody **R**stock; **L** alternate, lanceolate to oblong or linear-oblong in the upper stem parts, denticulate in the upper ½, finely pubescent on both faces, sessile, dark shining green; flowering **Br** erect, rather slender, thickly pubescent, 15 - 50 cm long, **Ha** spreading or deflexed, ½ as long as the stem Ø, white; **Inf** large dense corymbs, 5 - 10 cm Ø; **Bra** L-like, upper **Bra** mostly lanceolate, very small; **Fl** 5- to 6-merous; **Sep** linear-lanceolate, obtuse, fleshy, pubescent dorsally, 3 - 4 mm; **Pet** connate for up to 2 mm, broadly lanceolate, acuminate or mucronate, sparsely pilose along the midrib, 5 - 6 mm, yellow; **Fil** slightly shorter than the **Pet**, yellow; **Anth** orange; **N**Sc square, small, yellowish; **Fr** connate for up to 1.5 mm, glabrous, many-seeded, 5 - 6 mm; **Se** multipapillate.

The most distinct species within Subgen. *Aizoon* because of its conspicuous eglandular hairs.

P. sichotensis (Voroschilov) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 169, 1995). – **D:** Russia (Far East). **I:** Stephenson (1994: 156, as *Sedum*).

≡ *Sedum sichotense* Voroschilov (1961) ≡ *Sedum middendorffianum* ssp. *sichotense* (Voroschilov) Voroschilov (1985) ≡ *Aizopsis middendorffiana* ssp. *sichotensis* (Voroschilov) S. Gontcharova (1999).

[2] Glabrous small perennial herbs, ascending, tufted, to ± 10 cm; otherwise like *P. kamtschaticus*.

Very close to and almost indistinguishable from many small forms of the variable *P. kamtschaticus*. Gontcharova (2000: 126, as *Aizopsis*) classified this species as a subspecies of *P. middendorffianus*.

P. sikokianus (Maximowicz) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 169, 1995). **T:** Japan, Tosa Prov. (*Makino* s.n. [T]). – **D:** Japan (Shikoku Island, endemic); 1300 - 1900 m. **I:** Moran (1971: as *Sedum*).

≡ *Sedum sikokianum* Maximowicz (1892) ≡ *Aizopsis sikokiana* (Maximowicz) Grulich (1984).

[2] Small glabrous herbs with short rhizomes and short ascending flowering **Br** to 20 cm; **L** opposite, sessile or petiolate, spatulate-oblong to cuneate-spatulate or rhombic, crenate, 10 - 27 × 6 - 12 mm;

Inf few-flowered cymes; **Bra** few, small; **Ped** 1 - 2 mm; **Fl** 5-merous; **Sep** linear, 3 - 4 mm; **Pet** spreading, linear-lanceolate, cuspidate, 6.5 mm, yellow; **N**Sc square; **Sty** slender, 1 - 1.5 mm; **Fr** stellately patent with distinct lips along the sutures, brown; **Se** ovate-oblong, papillose. – *Cytology*: 2n = 16 (Amano & Ohba 1990).

A rare and until recently rather unknown species. It may be a key-species for understanding the evolution of the whole Subgen. *Aizoon* because of its low diploid chromosome number and the opposite leaves.

P. spurius (M. von Bieberstein) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). **T:** Georgia (*Bieberstein* s.n. [LE]). – **Lit:** Jalas & al. (1999: 106). **D:** Georgia (Caucasus), N Iran, NE Turkey (Anatolia); rocky sites and sub-alpine meadows, 1250 - 3000 m; naturalized in many parts of Europe. **Fig. XXV.d**

≡ *Sedum spurium* M. von Bieberstein (1808) ≡ *Asterosedum spurium* (M. von Bieberstein) Grulich (1984) ≡ *Spathulata spuria* (M. von Bieberstein) A. Löve & D. Löve (1985); **incl.** *Crassula crenata* Desfontaines (1808) ≡ *Sedum crenatum* (Desfontaines) Boissier (1872); **incl.** *Sedum involucreatum* M. von Bieberstein (1808) ≡ *Sedum spurium* var. *involucreatum* (M. von Bieberstein) Fröderström (1936); **incl.** *Sedum oppositifolium* Sims (1815); **incl.** *Anacampseros ciliaris* Haworth (1819) ≡ *Sedum ciliare* (Haworth) Sweet (1826); **incl.** *Anacampseros dentata* Haworth (1821) ≡ *Sedum dentatum* (Haworth) Haworth (1828); **incl.** *Sedum denticulatum* Donn ex De Candolle (1828); **incl.** *Sedum lazicum* Boissier & Huet (1856); **incl.** *Sedum congestum* K. Koch ex Boissier (1872) (*nom. inval.*, Art. 32.1c); **incl.** *Sedum spurium* var. *album* Trautvetter (1876).

[1] Perennial herbs with numerous procumbent or creeping, rooting, glabrous or somewhat papillose sterile stems, 5 - 15 cm long; **L** opposite or rarely alternate, sessile or shortly petiolate, spatulate to obovate or orbicular, cuneate, usually crenate in the upper part, 15 - 35 × 10 - 12 mm; flowering **Br** procumbent or ascending, papillose, 10 - 30 cm; **Inf** rather dense corymbs with 3 - 5 **Br** and 15 - 30 **Fl**; **Bra** oblanceolate to oblong, papillose; **Fl** 5-merous or rarely 6-merous, subsessile or with short **Ped**; **Sep** deltoid-lanceolate, obtuse to acute, papillose towards tip, to 10 mm; **Pet** erect in the lower part and usually spreading above, subovate, short- or sometimes long-mucronate, with slightly recurved tips, carinate, 7 - 12 mm, pure white to crimson; **Fil** 5 - 9 mm; **Anth** red; **N**Sc ± 0.5 × 1 mm; **Fr** basally connate, (sub-) erect, glabrous, 5 - 9 mm. – *Cytology*: 2n = 28, 42.

A variable species in respect to size and dentation of the leaves and flower colour. The white-flowered forms (*Sedum involucreatum* and *S. oppositifolium*) seem to be the dominant race in the NE

part of the range, whereas the red-flowered forms are more abundant in the W parts. However, there seems to be little use for segregate taxa regarding the cytological uniformity of the species.

P. stellatus (Linné) Rafinesque (Amer. Monthly Mag. & Crit. Rev. 1: 438, 1817). **T:** BM [lecto, Herb. Clifford, p. 176, *Sedum* 2]. – **Lit:** Jalas & al. (1999: 108). **D:** C and E Mediterranean Region (S France, Italy, Balkan, Greece, Turkey); naturalized in England (Somerset). **I:** Fröderström (1932: 85, t. 48, as *Sedum*). **Fig. XXVI.b**

≡ *Sedum stellatum* Linné (1753) ≡ *Anacampseros stellata* (Linné) Haworth (1812) ≡ *Asterosedum stellatum* (Linné) Grulich (1984); **incl.** *Sedum uniflorum* Rafinesque (1810) ≡ *Phedimus uniflorus* (Rafinesque) Rafinesque (1817); **incl.** *Sedum deltoideum* Tenore (1815).

[1] Annual glabrous herbs with erect or ascending, stout, simple or branched, sometimes papillose (upper part) stems 3 - 15 cm long; **L** opposite or sometimes alternate in the upper part, shortly petiolate or spatulate, obovate to orbicular, 7 - 20 mm, entire, sparingly crenate or bluntly dentate, sometimes papillose; **Inf** dense cymes with (1-) 5 - 15 (-25) **Fl** on (1-) 2 - 3 (-4) usually simple cincinni; **Bra** large, spatulate to oblong, ± 5 mm; **Fl** (4- to) 5-merous, (sub-) sessile; **Sep** basally connate to 1 mm, erect, broadly linear to lanceolate, papillose at the tip, 4 - 6 mm; **Pet** basally free, oblong, broadly mucronate, 4 - 5 mm, white, pink or purplish-red; **Fil** 2 - 2.5 mm; **Anth** red; **NSc** subquadrate-spatulate, 0.7 × 0.5 mm; **Fr** stellately patent with distinct lips along the sutures; **Se** 0.8 × 0.5 mm. – *Cytology*: 2n = 10.

Artificially obtained hybrids with *P. stoloniferus* (2n = 13) were annual and sterile.

P. stevenianus (Rouy & Camus) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). **T:** Georgia (*Steven* s.n. [LE]). – **D:** Georgia (E and C Caucasus); rocky sites in the alpine zone.

≡ *Sedum stevenianum* Rouy & Camus (1901) ≡ *Asterosedum stevenianum* (Rouy & Camus) Grulich (1984); **incl.** *Sedum roseum* Steven (1812) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum hametianum* Leveillé (1916).

[1] Glabrous perennial herbs with very short, branching, densely leafy, ascending, sterile stems, rooting at the nodes; **L** decussate, spatulate to spatulate-obovate or ovate-cuneate, entire, very fleshy, sessile, 2 - 6 × 1 - 4 mm; flowering **Br** appressed to the ground or ascending, slender, flexuous, glabrous, 2.5 - 10 cm; **Inf** corymbs with 3 - 9 **Fl**; **Bra** **L**-like to very small and **Sc**-like; **Ped** ± 4 mm; **Fl** 5-merous; **Sep** basally connate, linear-lanceolate, obtuse, 1.5 - 3 mm; **Pet** oblong-lanceolate to subovate, subobtusate or shortly mucronate, entire, carinate with reddish keel, 4.5 - 7 mm, whitish to pink; **Fil**

1.5 - 6 mm; **Anth** pink or reddish; **NSc** sub-orbicular, 0.5 × 1 mm, pale orange; **Fr** erect, green; **Se** ± 0.7 mm, brown.

P. stevenianus seems to be endemic to the E and C Caucasus (Grossheim 1950) and its occurrence in China is very unlikely (Fu & Fu 1984: 157). Consequently, *Sedum hametianum* is placed here with great doubt.

P. stoloniferus (S. G. Gmelin) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 168, 1995). **T:** Iran, Ghilan (*Gmelin* s.n. [B]). – **D:** Caucasus, N Iran (Talish), E Turkey (N Anatolia, Hatay); forests, moist banks etc., to 2150 m; frequently cultivated throughout Europe and N America and often naturalized (to 60° N in Scandinavia). **I:** Fröderström (1932: 50, t. 28, as *Sedum*).

≡ *Sedum stoloniferum* S. G. Gmelin (1774) ≡ *Asterosedum stoloniferum* (S. G. Gmelin) Grulich (1984); **incl.** *Sedum ibericum* Steven ex M. von Bieberstein (1819); **incl.** *Sedum hybridum* d'Urville ex Boissier (1872) (*nom. illeg.*, Art. 53.1).

[1] Perennial herbs with branched creeping sterile stems, rooting at the nodes, to 12 cm long; **L** crowded at the stem tips, opposite, obovate to orbicular or elliptic, obscurely crenate or dentate, mamillate, cuneate, pseudopetiolate with a 5 - 10 mm long petiole, lamina fleshy, 10 - 25 × 6 - 10 mm; flowering **Br** erect or ascending, simple, glabrous or papillose, 10 - 45 cm; **Inf** lax (10- to) 20- to 30-flowered corymbs; **Bra** broadly oblanceolate, mamillate, 4 - 8 mm; **Fl** 5-merous, sessile; **Sep** connate for up to 1 mm, oblanceolate, glabrous, 2.5 - 4.5 mm; **Pet** lanceolate, shortly mucronate, widely spreading, 6 - 8 mm, pale pink; **Fil** 3.5 - 4 mm; **Anth** red; **NSc** subquadrate; **Fr** basally connate, stellately spreading, glabrous, 5 - 6 mm; **Se** 1 × 0.5 mm. – *Cytology*: 2n = 14.

The report of 2n = 28 for *P. stoloniferus* by Baldwin (1935) is certainly erroneous as the accompanying figure clearly shows the large chromosomes of the *P. spurius* karyotype.

P. takesimensis (Nakai) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 169, 1995). **T** [lecto]: Korea, Gyeongbook Prov. (*Nakai* 4682 [TI]). – **D:** Korea (Tok and Ullu Islands); endemic. **I:** Lee (1998: 273).

≡ *Sedum takesimensense* Nakai (1919) ≡ *Sedum kamtschaticum* var. *takesimensense* (Nakai) Park (1974) ≡ *Aizopsis takesimensis* (Nakai) P. V. Heath (2001).

[2] Perennial robust glabrous herbs with large, thick and woody **Rstock** and decumbent, sometimes caespitose stems with reddish base, to 40 cm long; **L** alternate, lanceolate, linear-lanceolate, spatulate or obovate, obtuse, dentate or serrate in the upper ½, 2 - 8 cm long, shortly petiolate; flowering **Br** 40 cm; **Inf** terminal cymes with 3 - 5 cincinni; **Fl** (4- to) 5- (to 6-) merous, sessile; **Sep** linear to lanceo-

late, obtuse, 3.5 - 4 mm; **Pet** 8 mm, yellow; **Fil** almost as long as the **Pet**, yellow; **Anth** reddish-yellow; **NSc** white; **Fr** many-seeded; **Se** ovoid, 1.2 mm, costate or multipapillate.

P. zokuriensis (Nakai) 't Hart (in 't Hart & Egli (eds.), *Evol. Syst. Crassulaceae*, 169, 1995). **T:** Korea, Tyuhoku Prov. (*Nakai* 14952 [TI]). – **D:** Korea; cliffs in forests. **I:** Chung & Kim (1989: 215, t. 23A, as *Sedum*).

≡ *Sedum zokuriense* Nakai (1939) ≡ *Sedum kamtschaticum* var. *zokuriense* (Nakai) Park (1974) ≡ *Aizopsis zokuriensis* (Nakai) P. V. Heath (2001); **incl.** *Sedum prostratum* Nakai (1935) (*nom. inval.*, Art. 32.1c).

[2] Glabrous herbs with woody tuberous short rhizomes to 2 cm long, with prostrate slender stems to 22 cm, sometimes rooting near the base; **L** opposite or alternate, obovate to oblong-obovate or elliptic to spatulate, 1 - 2 cm, obtuse, margins crenate-serrate, 2 - 3 mm petiolate; flowering **Br** glabrous, 10 - 22 cm, branched in the upper part; **Inf** terminal, glabrous, leafy, cymes to 1 cm Ø, with 3 - 4 cincinni; **Fl** 4- to 7-merous, sessile; **Sep** lanceolate to subulate, obtuse, $\pm 4 \times 0.5 - 0.7$ mm; **Pet** lanceolate, acute, ± 8 mm, yellow; **Fil** ± 7 mm; **Anth** small, rounded, yellow; **Fr** ± 2 mm; **Se** ovoid, 1.6 mm.

Status and position within Subgen. *Aizoon* are uncertain.

PISTORINIA

H. 't Hart

Pistorinia De Candolle (PSRV 3: 399, 1828). **T:** *Cotyledon hispanica* Linné [Typification by inference, only element included.]. – **Lit:** Jalas & al. (1999: 51 [distribution maps]). **D:** Iberian Peninsula, N Africa. **Etym:** For Jacobo (Jaime or Santiago) Pistorini (fl. 1766 - 1775), Spanish physician of Italian origin, physician in ordinary of King Carlos III.

Glandular-pubescent annual herbs with erect stems; **L** alternate, sessile, terete to semiterete, with entire margins, green, often tinged with red; **Inf** terminal, usually many-flowered cymes; **Bra** 1 per **Fl**; **Fl** 5-merous, obdiplostemonous, pedicellate; **Sep** broadly sessile, acute to acuminate, green; **Pet** yellow, pink or purple, often finely spotted, long, basally connate for $\frac{1}{2}$ or more forming a distinct **Cl** tube, lobes spreading during anthesis; **Fil** inserted below the mouth of the **Cl** tube, short; **Sty** long, slender, recurved; **NSc** long; **Fr** erect, slender, brown; **Se** ellipsoid, brown, costate.

A small genus with perhaps only 2 distinct species, though Castroviejo (1997) estimates the total number of species at 5 or 6. Like in all annual *Crassulaceae*, individual plants within a population may vary considerably in habit, branching, and size and shape of the leaves, inflorescences and even flo-

wers. In addition, species of *Pistorinia* vary in the coloration of the flowers and in the shape and length of the corolla tube. Particularly, differences in colour between the inner and outer face of the corolla lobes, and the patterns, numbers and colours of the dots on the inner face have induced the creation of a plethora of completely useless infraspecific names.

Traditionally, *Pistorinia* has been considered to be closely related to other sympetalous genera of the family, such as *Cotyledon*, *Kalanchoe* and *Umbilicus*, and accordingly, Berger (1930) classified it in subfamily *Cotyledonoideae*. Molecular phylogenetic studies, however, indicate that *Pistorinia* belongs to the well-defined monophyletic lineage containing the W Mediterranean *Sedum* Ser. *Dasyphylla*, Ser. *Pedicellata*, and Ser. *Subrosea* of subgenus *Gormanina*, according to Ham (1994) and 't Hart & al. (1999). Sympetaly evolved independently in several groups within this lineage, e.g. in *Sedum candollei*, *S. lagascae* and *S. mucizonia* ('t Hart & al. 1999).

P. brachyantha Cosson (Bull. Soc. Bot. France 22: 59, 1875). – **D:** W Morocco. **I:** Maire (1977: 287, fig. 103).

≡ *Cotyledon brachyantha* (Cosson) Maire (1977); **incl.** *Cotyledon hispanica* ssp. *cossoniana* Ball (1873) ≡ *Cotyledon cossoniana* (Ball) Maire (1932); **incl.** *Pistorinia breviflora* Cosson (1873) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon cossoniana* var. *aurea* Maire (1932) ≡ *Cotyledon brachyantha* var. *aurea* (Maire) Maire (1977); **incl.** *Cotyledon cossoniana* var. *ochroleuca* Maire (1932) ≡ *Cotyledon brachyantha* var. *ochroleuca* (Maire) Maire (1977); **incl.** *Cotyledon cossoniana* var. *purpurea* Maire (1936) ≡ *Cotyledon brachyantha* var. *purpurea* (Maire) Maire (1977); **incl.** *Cotyledon cossoniana* var. *versicolor* Maire (1937) ≡ *Cotyledon brachyantha* var. *versicolor* (Maire) Maire (1977).

Similar to *P. breviflora* except for the smaller flowers; **Sep** linear-lanceolate, ± 3 mm, acuminate; **Pet** yellow to purple, 5.5 - 9 mm, basally connate for 4 - 6 mm forming an infundibuliform tube, lobes ovate or lanceolate, 1.5 - 3 mm, acute-mucronate; **Anth** yellow; **Sty** 2 mm; **NSc** linear, ± 1 mm; **Fr** erect.

A doubtful species that merely differs from *P. breviflora* in its smaller flowers.

P. breviflora Boissier (Elench. Pl. Nov., 42, 1838). **T** [lecto]: Spain, Andalucia (*Haenseler* s.n. [G-BOIS]). – **D:** S Spain, N Africa; sea-level to ± 1000 m. **I:** Castroviejo (1997: 109: t. 32: e-g).

≡ *Cotyledon breviflora* (Boissier) Maire (1925); **incl.** *Cotyledon hispanica* Desfontaines (1798) (*nom. illeg.*, Art. 53.1); **incl.** *Pistorinia salzmännii* Boissier (1840) (*nom. illeg.*, Art. 52.1) ≡ *Cotyledon breviflora* ssp. *salzmännii* (Boissier ex Emberger) Maire (1932) ≡ *Cotyledon salzmännii* (Boissier ex

Emberger) H. Lindberg (1932) $\equiv$ *Pistorinia breviflora* ssp. *salzmännii* (Boissier) H. Jacobsen (1958); **incl.** *Pistorinia intermedia* Boissier & Reuter (1856) $\equiv$ *Pistorinia salzmännii* ssp. *intermedia* (Boissier & Reuter) Battandier (1899) (*incorrect name*, Art. 11.4) $\equiv$ *Cotyledon breviflora* ssp. *intermedia* (Boissier & Reuter) Maire (1932) $\equiv$ *Pistorinia breviflora* ssp. *intermedia* (Boissier & Reuter) H. Jacobsen (1958); **incl.** *Pistorinia salzmännii* fa. *flaviflora* Battandier (1889) (*incorrect name*, Art. 11.4) $\equiv$ *Cotyledon breviflora* var. *flaviflora* (Battandier) Maire (1932); **incl.** *Pistorinia salzmännii* fa. *rubella* Battandier (1889) (*incorrect name*, Art. 11.4) $\equiv$ *Cotyledon breviflora* var. *rubella* (Battandier) Maire (1932); **incl.** *Cotyledon breviflora* fa. *concolor* H. Lindberg (1932); **incl.** *Cotyledon breviflora* fa. *maculigera* H. Lindberg (1932); **incl.** *Cotyledon breviflora* var. *flava* Maire (1932); **incl.** *Cotyledon breviflora* var. *rhodantha* Maire (1932) $\equiv$ *Pistorinia breviflora* var. *rhodantha* (Maire) H. Jacobsen (1958); **incl.** *Cotyledon salzmännii* fa. *punctata* H. Lindberg (1932) $\equiv$ *Cotyledon breviflora* fa. *punctata* (H. Lindberg) Maire (1977); **incl.** *Cotyledon salzmännii* fa. *purpureo-apiculata* H. Lindberg (1932) $\equiv$ *Cotyledon breviflora* fa. *purpureo-maculata* (H. Lindberg) Maire (1977); **incl.** *Cotyledon salzmännii* fa. *unicolor* H. Lindberg (1932) $\equiv$ *Cotyledon breviflora* fa. *unicolor* (H. Lindberg) Maire (1977); **incl.** *Cotyledon breviflora* var. *variegata* Gattefossé & Maire (1938); **incl.** *Cotyledon breviflora* var. *subbrachyantha* Maire (1977); **incl.** *Cotyledon breviflora* var. *xanthantha* Maire (1977) (*nom. inval.*, Art. 36.1, 37.1).

Stems erect, firm, sometimes branched, to 15 cm tall; **L** terete to semiterete, elliptic-ovate, 7 - 12.5 (-16) $\times$ 1 - 2 (-4.5) mm, obtuse or subacute, green, often tinged with red; **Inf** lax, usually many-flowered cymes with 2 or more often branched cincinni; **Bra** small; **Ped** 1 - 6.5 mm; **Sep** lanceolate, 2 - 2.5 mm, acute-acuminate; **Pet** yellow, 8 - 20 (-25) mm, basally connate for 5 - 13 mm forming an infundibuliform tube, lobes ovate, 4.5 - 6 (-7) mm, acute, inner face often with variable numbers of red dots; **Fil** yellow; **Anth** yellow; **Fr** erect, 6 - 7 (-10) mm.

Extremely polymorphic in respect to the amount of purple coloration of the corolla, and size and shape of the corolla tube. Although local populations are often quite uniform in these characters, the total variation is a continuous series that renders the naming of these forms utterly futile.

P. hispanica (Linné) De Candolle (PSRV 3: 399, 1828). **T:** Spain (*Loefling* s.n. [LINN]). – **D:** Spain, Portugal, N Africa (Morocco, Tunisia, Algeria); 1200 - 1900 m. **I:** Castroviejo (1997: 109: t. 32: a-d).

$\equiv$ *Cotyledon hispanica* Linné (1753) $\equiv$ *Sedum hispanicum* (Linné) Hamet (1929) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon hispanica* fa. *flaviflora* Maire

(1922) $\equiv$ *Cotyledon hispanica* var. *flaviflora* (Maire) Maire (1932) $\equiv$ *Pistorinia hispanica* var. *flaviflora* (Maire) H. Jacobsen (1958); **incl.** *Cotyledon hispanica* var. *flaviflora* Maire (1922) (*incorrect name*, Art. 11.4) $\equiv$ *Cotyledon attenuata* fa. *flaviflora* (Maire) Maire (1977) (*incorrect name*, Art. 11.4); **incl.** *Cotyledon hispanica* var. *purpurea* Maire (1930) $\equiv$ *Cotyledon attenuata* var. *purpurea* (Maire) Maire (1941) (*incorrect name*, Art. 11.4) $\equiv$ *Pistorinia hispanica* var. *purpurea* (Maire) H. Jacobsen (1958) $\equiv$ *Cotyledon attenuata* var. *purpurea* (Maire) Maire (1977) (*incorrect name*, Art. 11.4); **incl.** *Cotyledon hispanica* var. *maculata* Maire (1932) $\equiv$ *Cotyledon attenuata* var. *maculata* (Maire) Maire (1941) (*incorrect name*, Art. 11.4) $\equiv$ *Pistorinia hispanica* var. *maculata* (Maire) H. Jacobsen (1958); **incl.** *Cotyledon attenuata* ssp. *mairei* H. Lindberg (1932) (*incorrect name*, Art. 11.4) $\equiv$ *Pistorinia attenuata* ssp. *mairei* (H. Lindberg) Greuter (1981); **incl.** *Cotyledon attenuata* H. Lindberg (1932) (*nom. illeg.*, Art. 53.1); **incl.** *Cotyledon attenuata* fa. *eu-maculata* Maire (1977) (*nom. inval.*, Art. 36, 37); **incl.** *Pistorinia attenuata* Greuter (1981).

Stems erect, usually simple, to 20 cm tall; **L** terete to semiterete, oblong-elliptic, 5.5 - 14 $\times$ 1.5 - 4 mm, obtuse, green, often tinged with red; **Inf** rather dense usually many-flowered cymes with 2 or more often branched cincinni; **Bra** small; **Ped** 2 - 5 (-8) mm; **Sep** triangular-lanceolate, 0.5 - 1.5 mm, acute; **Pet** pink to violet, or yellow to yellow-spotted, 8.5 - 22.5 (-30) mm, basally connate for 7 - 18 (-24) mm forming a cylindrical narrow tube, lobes ovate, 3 - 5 mm, acute, spreading during anthesis, inner face often with variable numbers of red dots; **Fil** white or pink; **Anth** whitish to red; **Sty** recurved; **NSc** linear, to 2 mm; **Fr** slender, to 10 mm. – *Cytology*: 2n = 14.

European plants have distinctly pink or violet flowers. The Moroccan *Cotyledon attenuata*, which is included in *P. hispanica* here, is identical to the European plants except for the yellow- or purple-spotted flowers.

PROMETHEUM

H. 't Hart

Prometheum (A. Berger) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12(4): 168, 1978). **T:** *Sedum sempervivoides* Fischer. – **D:** N Greece, Turkey, Armenia, Caucasus, N Iran; usually high altitudes. **Etym:** After the Greek mythological figure Prometheus who stole the fire from Zeus and was subsequently chained to the Caucasus for punishment; for the blood-red flowers of the type species which occurs in the Caucasus.

Incl. *Pseudorosularia* Gurgendize (1978) (*nom. illeg.*, Art. 52.1). **T:** *Sedum pilosum* M. von Biebertstein.

Perennial or monocarpic (annual to biennial), usually densely finely glandular-pubescent herbs; **Ros** dense, flattish globose (esp. in the dry season); **L** alternate, sessile, succulent, flat to semiterete, oblong to obovate-spatulate; **Inf** erect, terminal or lateral, usually stout, to 25 cm, cymose or corymbose, with 2 to many, sometimes forked cincinni; **Bra** 1 per **Fl**, usually minute; **Fl** 5-merous, shortly pedicellate; **Sep** broadly sessile; **Pet** basally connate for $< \frac{1}{2}$ of their length, with spreading or suberect lobes, yellow, cream, white, pink or red; **St** 10; **Anth** red, sometimes yellowish; **NSc** transversely oblong to square, ≤ 1 mm; **Fr** follicles stellately patent with distinct lips along the ventral suture, or erect or spreading with indistinct lips; **Se** oblong-ovoid, costate. – *Cytology*: $x = 6, 7$.

Prometheum is a small, morphologically distinct, monophyletic group of 8 species which evolved from *Sedum* Subgen. *Gormanina* in the Irano-Turanian region. It was included in *Rosularia* because of its dense rosettes and sympetalous flowers. It differs, however, by the absence of a well-developed caudex, the cymose instead of paniculate inflorescence, the usually less connate petals and the lack of ciliae along the leaf margins. *Prometheum* is cytologically quite uniform with a basic number of $x = 7$ in all but 1 species ($x = 6$ in *P. pilosum*). The 3 species formerly included in *Sedum* Sect. *Sempervivoides* seem quite distinct, but chloroplast DNA studies indicate that *P. pilosum* is closer to *P. aizoon* than to *P. sempervivoides* with which it can be hybridized. The rosulate and predominantly monocarpic species of *Sedum* Ser. *Cepaea* differ from *Prometheum* by the usually many-flowered pyramidal panicles or racemose thyrses and free petals (slightly connate in *Sedum cypricum*). Ser. *Cepaea* is cytologically uniform with a basic number of $x = 11$ (and a few dysploid cytotypes with $x = 10$).

P. aizoon (Fenzl) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 170, 1995). **T**: Turkey (Kotschy 204 [W, B, E, G, HEID, K, LE, UPS]). – **D**: Turkey, Armenia. **I**: Eggli (1988: 42, as *Rosularia*). **Fig. XXVIe**

≡ *Umbilicus aizoon* Fenzl (1842) ≡ *Cotyledon aizoon* (Fenzl) Schönland (1890) ≡ *Sedum chrysanthum* var. *aizoon* (Fenzl) Hamet (1929) ≡ *Rosularia aizoon* (Fenzl) A. Berger (1930) ≡ *Sedum chrysanthum* ssp. *aizoon* (Fenzl) R. T. Clausen (1975); **incl.** *Umbilicus pallidus* Schott & Kotschy (1857) ≡ *Rosularia pallida* (Schott & Kotschy) Stapf (1923); **incl.** *Rosularia tauricola* Kit Tan (1989).

Caudex absent; **R** as thickened taproot to 4 mm Ø; **Ros** sessile, $\pm$ semiglobular, 1.5 - 3 cm Ø, commonly in small groups and densely packed; offsets shortly stalked or subsessile; **L** oblong to narrowly elliptic, sometimes spatulate, fresh to blue-green (ochre and papery when dry), densely glandular-hairy, apex rounded; **Inf** $\pm$ reduced and normally la-

teral thyrses, lax or dense, 3- to 12-flowered; **Fl** broadly funnel-shaped or opening star-like, outer parts glandular-hairy; **Pet** 7 - 8 mm or longer, united for $\frac{1}{3}$, dark sulfur- to golden-yellow, venation concolorous or rarely purplish; **NSc** square or slightly oblong, whitish or yellowish. – *Cytology*: $2n = 14, 26, 28, 70$.

Material in cultivation under this name frequently turns out to be *P. chrysanthum*, which is primarily distinguished by the inflorescence always being terminal, and by its more tubular-campanulate flowers. Diploid plants are common throughout the area of the species. The tetraploid and decaploid cytotypes were all reported for plants from SE Turkey ('t Hart & Eggli 1988). – [H. 't Hart & U. Eggli]

P. chrysanthum (Boissier) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 170, 1995). **T**: Turkey (Heldreich s.n. [G, K, LE [photo]]). – **D**: SW and S Turkey, 1400 - 2500 m. **I**: Eggli (1988: 52, as *Rosularia*). **Fig. XXVIId**

≡ *Umbilicus chrysanthus* Boissier & Heldreich ex Boissier (1849) ≡ *Cotyledon chrysantha* (Boissier) Bornmüller (1914) ≡ *Sedum chrysanthum* (Boissier) Hamet (1929) ≡ *Rosularia chrysantha* (Boissier & Heldreich ex Boissier) Takhtajan (1953); **incl.** *Sedum chrysanthum* var. *genuinum* Hamet (1929) (*nom. inval.*, Art. 24.3).

Caudex absent, with slightly thickened tap**R**; **Ros** $\pm$ depressed-globose, 1.5 - 3 cm Ø, clump-forming with sessile or short-stalked offsets; **L** oblong to narrowly elliptic, fleshy, fresh green (pale ochre-brownish when dry), mostly densely glandular-hairy; **Inf** terminal lax panicles, 5- to 50-flowered; **Fl** tubular-campanulate to narrowly funnel-shaped, 10 - 14 mm, outer parts glandular-hairy; **Pet** united for $\frac{1}{3}$ to $\frac{2}{3}$, ivory-white to pale yellow, venation concolorous or pale reddish; **Ca** slender with distinctly offset **Sty**. – *Cytology*: $2n = 70, 84$.

Frequently encountered in cultivation under the incorrectly applied name *Rosularia pallida* (see comment for *P. aizoon*). – [H. 't Hart & U. Eggli]

P. muratdagense (Kit Tan) 't Hart (Succulenta 78(5): 236, 1999). **T**: Turkey, Kütahya (Davis 36820A [E, RSA]). – **D**: W Turkey; igneous rocks, 2100 m. **I**: Eggli (1992a: as *Rosularia*). **Fig. XXVI.f**

≡ *Rosularia muratdagensis* Kit Tan (1989).

Caudex none, but with tap**R**; **Ros** depressed-globular, 1.5 - 3 cm Ø, clump-forming with many subsessile offsets; **L** broadly spatulate with mucronate apex, fairly succulent, 0.8 - 1.2 cm, glabrous, pale to medium fresh green, apically commonly tinged with dark to bright red, margins with scattered ciliae or glandular **Ha**; **Inf** terminal, paniculate, 5 - 10 cm; **Fl** tubular to narrowly funnel-shaped, ± 1.2 cm; **Pet** united for $\pm \frac{1}{2}$, dorsally glandular along the midrib, pale yellowish to ivory,

sometimes with reddish streaks. – *Cytology*: $2n = 56$.

Vegetatively very close to *P. chrysanthum* and *P. serpentanicum*. – [H. 't Hart & U. Eggli]

P. pilosum (M. von Bieberstein) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12(4): 169, 1978). **T**: Georgia (*Bieberstein* s.n. [LE]). – **D**: Turkey (NE Anatolia), Georgia, Armenia, Caucasus, N Iran; on rocks, in crevices, 1000 - 2400 m. **Fig. XXVIIb**

≡ *Sedum pilosum* M. von Bieberstein (1808) ≡ *Rosularia pilosa* (M. von Bieberstein) Borissova (1939) ≡ *Pseudorosularia pilosa* (M. von Bieberstein) Gurgendize (1978) (*incorrect name*, Art. 11.4); **incl.** *Cotyledon pubescens* C. A. Meyer (1831) (*nom. illeg.*, Art. 52.1) ≡ *Umbilicus pubescens* (C. A. Meyer) Ledebour (1843) (*nom. illeg.*, Art. 52.1); **incl.** *Sedum regelii* hort. ex Borissova (1939) (*nom. inval.*, Art. 34.1c).

Small glandular-pilose biennials with slender **R**; **Ros** small, to 2 cm Ø, globose; **L** ovate-oblong to oblong-spatulate or ovate-spatulate, flat, fleshy, obtuse, 7 - 10 × 3 - 5 mm, bright green; **Inf** terminal, usually simple, 5 - 10 cm; **Inf** umbellate-corymbiform or semiglobose corymbs with 6 - 18 **Fl**; **Ped** 4 - 6 mm; **Sep** basally slightly connate, linear-lanceolate, acuminate, 3.5 - 5 × 1 - 1.5 mm, erect, green; **Pet** 6 - 8 mm, basally connate, pinkish, pink-violet or whitish, lobes oblong-ovate, subacute, recurved, 1 - 1.5 mm wide; **Anth** red; **Sty** green or reddish; **NSc** oblong-ovate, emarginate, whitish; **Fr** pilose, stellate-patent, with distinct pale lips along the sutures; **Se** ± 0.8 mm, pale brown. – *Cytology*: $2n = 12$.

The rosettes are solitary in nature, but cultivated plants often branch to produce dense clumps.

P. rechingeri (Jansson) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 170, 1995). **T**: Iraq, Erbil Distr. (*Rechinger* 11883 [W]). – **D**: E Turkey, adjacent N Iraq. **I**: Eggli (1988: 79, as *Rosularia*).

≡ *Rosularia rechingeri* Jansson (1966); **incl.** *Umbilicus libanoticus* fa. *minor* Nábelek (1923).

Caudex absent but with ± thickened tap**R**; **Ros** semiglobular, 1 - 3.5 cm Ø, fairly compact, clump-forming, offsets shortly stalked; **L** ovate-oblong to spatulate with rounded apex, 0.8 - 1.6 cm, fairly succulent, dull medium green, glabrous or laxly glandular-hairy, margin hairy; **Inf** lateral racemose thyrses, (1- to) 4- to 17-flowered, 3 - 10 cm, upper ½ ± glandular-hairy; **Fl** 1 - 1.5 cm or shorter, slender funnel-shaped to almost tubular with reflexed **Pet** tips, outer parts glandular-hairy; **Pet** united for ½, greenish-yellow to ivory, often with purplish venation, apex aristate; **NSc** semi-orbicular to square; **Ca** slender; **Sty** distinctly offset. – *Cytology*: $2n = ± 104$.

The affinities of this taxon are clearly with *P.*

chrysanthum and *P. aizoon*, but the differentiation esp. from the latter needs further clarification. It is most probably 16-ploid, based on a secondary dysploid basic number of $x = 13$. – [H. 't Hart & U. Eggli]

P. sempervivoides (Fischer ex M. von Bieberstein) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12(4): 169, 1978). **T**: Georgia (*Wilhelms* s.n. [LE, E]). – **D**: Turkey (Anatolia), Georgia, Armenia, Caucasus, N Iran; dry stony or rocky slopes, screes, 1200 - 2900 m. **Fig. XXVIa, XXVIc**

≡ *Sedum sempervivoides* Fischer ex M. von Bieberstein (1819) ≡ *Rosularia sempervivoides* (Fischer ex M. von Bieberstein) Borissova (1939) ≡ *Pseudorosularia sempervivoides* (Fischer ex M. von Bieberstein) Gurgendize (1978) (*incorrect name*, Art. 11.4); **incl.** *Sedum sempervivum* De Candolle (1828); **incl.** *Sedum divaricatum* Schlechtendal ex Ledebour (1843) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum kurdistanicum* Fröderström (1939).

Finely glandular-pubescent annuals or biennials with cord-like **R**; **Ros** usually flat, ± 3 - 5 cm Ø; **L** ovate to obovate-cuneate, flat, fleshy, sharply acuminate, 1 - 3 × 0.7 - 1.5 cm, pubescent, purplish; **Inf** terminal, erect, usually simple, robust, 7 - 25 cm, lax, 30- to 150-flowered, as corymbose panicles or corymbiform, to 12 cm Ø; **Ped** ± 4 - 7 mm; **Sep** basally slightly connate, triangular, acute, 2 - 4 × 1 - 1.5 mm, fleshy, red; **Pet** 6 - 8 mm, basally connate, deep red or scarlet, lobes lanceolate, acute, 1.5 - 2 mm wide; **Fil** red; **Anth** red; **Sty** reddish; **NSc** broadly obovate, to 0.5 mm; **Fr** stellately patent or divergent, sparsely pubescent, reddish, with distinct whitish lips along the sutures; **Se** ± 1 mm, pale brown. – *Cytology*: $2n = 14$.

The characteristic fiery-red flowers of *P. sempervivoides* is quite unique in the family and only paralleled in a few species of *Crassula* and *Kalanchoe*.

P. serpentanicum (Werdermann) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 170, 1995). **T** [neo]: Turkey, Mugla (*Davis* 13557 [E, K]). – **D**: SW Turkey.

≡ *Umbilicus serpentanicus* Werdermann (1938) ≡ *Rosularia serpentanica* (Werdermann) Muirhead (1972).

Vegetatively close to *P. chrysanthum* and *P. muratdagense*.

P. serpentanicum var. **giganteum** (Eggli) 't Hart (*Succulenta* 78(5): 236, 1999). **T**: Turkey, Mugla (*Carlström* s.n. [Z, ISTE, ZSS]). – **D**: SW Turkey (only known from the type locality near Marmaris), 150 m. **I**: Eggli (1988: 100, as *Rosularia*).

≡ *Rosularia serpentanica* var. *gigantea* Eggli (1987).

Differs from var. *serpentinica*: Larger in all parts; **Ros** to 11 cm Ø, usually solitary; **Inf** to 35 cm long, with up to 120 **Fl**. – *Cytology*: $2n = 28$.

Due to the large rosettes and the long leaves a well-differentiated taxon. Its occurrence at low altitudes is an exception, as all other taxa of the genus occur at altitudes above 1000 m.

P. serpenticum var. **serpenticum** – **D**: SW Turkey; serpentine endemic, 1500 - 2200 m. **I**: Eggli (1988: 100, as *Rosularia*). **Fig. XXVII.a**

Incl. *Rosularia serpentina* var. *serpentina*.

Caudex absent but with $\pm$ thickened tap**R**; **Ros** semiglobular, 1 - 3 cm $\varnothing$, commonly offsetting and forming compact clumps; **L** obovate-oblong, fairly fleshy, 0.6 - 1.5 cm, dark sea-green above, sometimes with bluish hue but not glaucous, apically and marginally tinged purplish, papery and ochre when dry, glabrous, apically with a conspicuous hydathode; **Inf** reduced terminal thyrses, 5- to 17-flowered, 5 - 8 cm, basally imbricately leafy, glandular-hairy; **Fl** 11 - 13 mm, narrowly campanulate, outer parts densely glandular-hairy; **Pet** united for $\frac{1}{3}$ - $\frac{1}{2}$, keeled, white with purple longitudinal stripes; **NSc** square to oblong, 0.4 - 0.7 mm; **Ca** $\pm$ slender, pale green, with distinctly offset **Sty**. – *Cytology*: $2n = 56$.

Each population of this taxon differs to some extent from others, no doubt due to the isolation caused by the distribution being confined to the higher mountains in SW Turkey. Only the giant rosettes of var. *giganteum* merit formal recognition. – [H. 't Hart & U. Eggli]

P. tymphaeum (Quézel & Contandriopoulos) 't Hart (in 't Hart & Eggli (eds.), *Evol. Syst. Crassulaceae*, 170, 1995). **T**: Greece (Quézel & Contandriopoulos s.n. [MARSSJ]). – **D**: N Greece; mountains, on rocks in crevices, limestone, 2000 - 2200 m, rare endemic and only known from 3 or 4 mountain tops. **I**: Contandriopoulos & al. (1966: 463, figs. 1-4, as *Sedum*). **Fig. XXVII.c**

$\equiv$ *Sedum tymphaeum* Quézel & Contandriopoulos (1967).

Perennials, densely covered with minute glandular **Ha**, sticky; **Ros** globose, forming offsets on short axillary stolons; **L** oblong-obovate to spatulate, flattened, 10 - 12 $\times$ 3 - 4 mm; **Inf** axillary, ascending or erect, 5 - 8 (-10) cm, generally as few-flowered corymbose cymes with 2 - 3, sometimes forked, cincinni; **Ped** to 8 mm; **Sep** basally slightly connate, oblong, 3 - 4 mm; **Pet** 7 - 9 mm, basally connate, with broadly ovate-elliptic, acute, 3 - 4 mm wide lobes, white or sometimes tinged with red; **Fil** white; **Anth** red; **Sty** $\pm$ 1 mm; **Fr** stellate-patent, yellowish-brown, with distinct paler (whitish) lips along the sutures; **Se** ovoid, brown. – *Cytology*: $2n = 14$.

Formerly included in *Sedum*, but closely related to the monocarpic *P. pilosum* and *P. sempervivoides*. The 3 species can be easily hybridized, but their hybrids are completely sterile ('t Hart & al. 1999).

PSEUDOSEDEM

H. 't Hart

Pseudosedum (Boissier) A. Berger (NPF2, 18a: 465, 1930). **T**: *Umbilicus lievenii* Ledebour [Typification by inference, only element included.]. – **Lit**: Borissova (1933); Borissova (1939: 79-86); Jansson & Rechinger (1970: 18-21); Pratrov (1974). **D**: C Asia; stony soils in mountainous regions. **Etym**: Gr. 'pseudo-', false; and for the genus *Sedum* ("Stonecrop"; *Crassulaceae*).

$\equiv$ *Umbilicus* Sect. *Pseudosedum* Boissier (1872).

Perennial glabrous herbs with 1 to numerous flowering stems arising from a usually well-developed, simple or branched, short or elongated sympodial rhizome with cordlike or often tuberous **R**, old stems usually persistent; **L** alternate, mostly linear, sometimes more oblong or narrowly lanceolate, (sub-) obtuse, broadly spurred, subterete, mostly fleshy, 4 - 25 mm; flowering **Br** 1 to many, simple, erect-ascending or sometimes lower part procumbent, mostly densely leafy, 5 - 40 cm long; **Inf** dense cymes, corymbose or umbellate, rarely paniculate, usually many-flowered, with arcuate, slightly up-curved, or erect, sometimes forked, usually short **Br**; **Bra** lanceolate to oblong, rarely linear, obtuse to acute or slightly mucronate, 2 - 5 mm; **Ped** 0 - 6 mm; **Fl** 6-merous (sometimes 5-merous), obdiplostemonous; **Sep** broadly sessile, sometimes basally slightly connate, linear-lanceolate to oblong or ovate, rarely triangular, acute to obtuse, 2 - 5 mm, greenish; **Pet** basally connate for $\frac{1}{3}$ to $\frac{2}{3}$, campanulate to tubular or sometimes ventricose, 6 - 15 mm, tips $\pm$ divergent, (oblong-) lanceolate to ovate or rarely broadly triangular, (sub-) acute or rarely submucronate, pink to violet or red or pure white, sometimes more intensely coloured along the midrib; **Anth** red to dark violet; **NSc** small, usually transverse-oblong; **Fr** many-seeded, erect or slightly divergent; **Se** ellipsoid to oblong, $\pm$ 1 mm, co-state.

According to Jansson & Rechinger (1970) the systematic limits between the species of *Pseudosedum* are somewhat diffuse and the whole genus might as well be regarded as monotypic with one (variable) species divided into a number of subspecies. Variation within *Pseudosedum* is mainly confined to the habit and size of the plants and subtle differences in the size and shape of the leaves, inflorescences and flowers. The variation in the vegetative structures (in particular caudex and roots), however, is difficult to appreciate and in urgent need of further study.

Molecular phylogenetic analyses of chloroplast DNA variation placed *Pseudosedum* in the *Telephi-*um clade (subtribus *Telephiinae* of Subfam. *Sedoidae*) as sister-genus of *Rhodiola*. The latter group has a monopodial rhizome, whereas other genera of the *Telephiinae*, such as *Hylotelephium*, *Phedimus* and *Umbilicus* have distinct sympodial rhizomes,

sometimes (*Hylotelephium*) in combination with tuberous roots. Most probably the *Pseudosedum* rhizome is sympodial though the various descriptions are not unequivocal in this respect. Two species (*P. acutisepalum* and *P. lievenii*) lack the tuberous roots but instead are described as having an elongated or robust rhizome (see Fröderström (1932: pl. 11); Borissova (1939: pl. 6.1)). However, a monopodial rhizome is suggested in several descriptions (e.g. *P. multicaule*) indicating the presence of a single thickened elongated root (caudex) bearing persistent old (flowering) stems and membranous, broadly triangular (bract) leaves (see Fröderström (1931: pl. 27); Borissova (1939: pl. 6.2)). In this account we have adopted a conservative course. In addition to a lengthy genus description there are brief descriptions of the 12 species listed by Berger (1930), Borissova (1939) and Jansson & Rechinger (1970). A critical study of this variable taxon is very much to be desired.

Editor's note: V. V. Byalt has kindly supplied additions to the descriptions and standardized the range information.

P. acutisepalum C.-A. Jansson (in K. H. Rechinger (ed.), *Fl. Iranica* 72: 19, 1970). **T:** Afghanistan, Ghorat (Rechinger 18874 [W]). – **D:** Iran, C Afghanistan (Ghorat); calcareous rocks and stony places, ± 2725 m, flowers May to July. **I:** Jansson & Rechinger (1970: t. 3).

Rhizome thick and long, ending in 2 to many non-tuberous **R**, 2 - 4 mm Ø; flowering **Br** 2 to many, to 15 cm; **Inf** corymbose-cymose; **Ped** 1 - 3 mm; **Fl** 6-merous; **Sep** triangular, acute, 3 - 4 mm; **Cl** 10 - 12 mm, campanulate, somewhat ventricose, lobes 5 - 6 mm; **Fr** erect; **Se** 1 - 1.4 mm. – [H. 't Hart & V. V. Byalt]

P. bucharicum Borissova (Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 1(1): 111, fig. 4, 1933). **T:** Tadzhikistan, Kulyab (*Anonymus* s.n. [LE]). – **D:** C Asia (Pamir and Alai regions: Zarafshan, Turkestan and Hyssar Ranges, hills of S Tadzhikistan, Tien Shan Mts. [Fergana Range]); stony mountain slopes, 900 - 1100 m, flowers April to May. **I:** Borissova (1975: 243, t. 47: fig. 1-6).

Rhizome short with many subfascicular slender branched **R**, to 2 mm Ø; **L** to 2 cm; flowering **Br** many, arcuate, 20 - 30 cm; **Inf** umbellate-paniculate, **Br** 2 - 3.5 cm; **Fl** 6-merous, subsessile; **Sep** obtuse, 1.4 - 2.5 mm; **Cl** funnel-shaped, 7 - 10 mm, lobes 4 - 5 mm, lanceolate, acute, red; **Fr** lanceolate in outline, 7.5 - 10.2 mm; **Se** oblong, 0.5 mm. – [H. 't Hart & V. V. Byalt]

P. campanuliflorum Borissova (Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 1(1): 115, fig. 8, 1933). **T:** Uzbekistan, Dzhizak (*Fedtschenko & Fedtschenko* 162 [LE]). – **D:** C Asia (Pamir and Alai regions: Dzhizak, Ingrychak

Pass); stony soils and rocks; 600 - 2000 m, flowers April to May. **I:** Borissova (1975: 242, t. 47: figs. 3-4).

Rhizome inconspicuous, with a single long robust vertical **R** 5 - 8 mm Ø and slender lateral **R**lets; **L** linear, obtuse, 10 - 15 × 1 - 1.5 mm; flowering **Br** many, 10 - 15 cm; **Inf** dense, umbellate-corymbose, 2.5 - 3.5 cm Ø, with short angular 2- or 3-flowered **Br**; **Bra** oblong-ovate, to 1.5 mm; **Fl** 5- or 6-merous, subsessile; **Sep** oblong-lanceolate, obtuse; **Cl** campanulate, 8 - 9 mm long, lobes to 3 mm, pink; **Fr** erect, 7 - 8 mm; **Se** oblong-ovoid, 1 mm. – [H. 't Hart & V. V. Byalt]

P. condensatum Borissova (Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 1(1): 110, fig. 3, 1933). **T:** Tadzhikistan (*Tuturin & Bessedin* 109a [LE]). – **D:** C Asia (Pamir and Alai regions), N, C and E Afghanistan, NW Pakistan (Chitral, Mt. Tirich Mir); stony slopes among shrubs, on rocks, (1750-) 2100 - 3600 m, flowers May to July. **I:** Borissova (1975: 245, t. 48: fig. 1-2).

Rhizome very short or with many subfascicular long slender often branching **R**, 1 - 1.5 mm Ø; **L** linear, to 2.5 mm, ± 1 mm wide; flowering **Br** 1 - 3, 15 - 25 cm; **Inf** corymbose, dense, with short **Br**, to 1.5 cm Ø; **Ped** 0 - 2 mm; **Fl** 6-merous (rarely 5-merous); **Sep** (sub-) obtuse, 2 - 3 mm; **Cl** 8 - 10 (-12) mm long, lobes 3.5 - 4.5 mm, pale violet; **Fr** 7 - 9 mm, semi-erect; **Se** oblong, ± 1 mm. – [H. 't Hart & V. V. Byalt]

P. fedtschenkoanum Borissova (Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 1(1): 114, fig. 7, 1933). **T:** Tadzhikistan (*Regel* s.n. [LE]). – **D:** C Asia: W Tien Shan (Kuraminsky Range), Pamir and Alai regions (Gissar, Nuratau, Zeravshan, Baldushan, Kabadian, Chalshau Ranges, Babatag and Kugitang); stony mountain slopes, calcareous and sandstone rocks, badlands, 450 - 2200 m, flowers March to May. **I:** Borissova (1955: 233, t. 25, fig. 5); Borissova (1975: 245, t. 48: figs. 5-6).

Rhizome short, divided into numerous slender tuberous **R**, to 2 cm long and 1 - 2 cm Ø; **L** linear, obtuse, to 1 cm long and to 1 mm Ø; flowering **Br** many, slender, 7 - 20 cm; **Inf** umbellate-corymbose, with slightly arcuate **Br** 0.5 - 1.5 cm long; **Bra** oblong-lanceolate, acute, 3.5 - 4 ± 0.5 mm; **Ped** 0 - 0.5 mm; **Fl** 5-merous, subsessile; **Sep** oblong-lanceolate, acute, 3 - 4 mm; **Cl** narrowly campanulate, 7 - 10 mm long, lobes acute, 3 - 4 × ± 2 mm, violet; **Fr** 6 - 8 mm, erect; **Se** pear-shaped. – [H. 't Hart & V. V. Byalt]

P. ferganense Borissova (Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 1(1): 112, fig. 5, 1933). **T:** Kirgizia, Fergana Prov. (*Transchel* s.n. [LE]). – **D:** C Asia (Pamir and Alai regions, Tien Shan Mts.).

P. ferganense ssp. **ferganense** – **D:** C Asia: Pamir and Alai regions (Alai Range), Tien Shan Mts. (Chatkal and Fergana Ranges); dry terraces and stony slopes, flowers June to August. **I:** Borissova (1939: 82, pl. 6: fig. 1).

Rhizome simple or branched with fusiform **R** or 1 - 3 (-4) tuberous $\pm$ terete **R** to 15 mm $\varnothing$; **L** oblong, 8 $\times$ 2 mm; flowering **Br** 1 - 3 (-5), (5-) 10 - 20 cm; **Inf** corymbiform, dense, 1.5 - 3 cm $\varnothing$; **Bra** lanceolate, acute, to 2 mm; **Ped** 1 - 5 mm; **Fl** 5- to 6-merous; **Sep** lanceolate, acute, 2 - 3 mm; **Cl** campanulately funnel-shaped, 10 - 12 mm long, lobes oblong-lanceolate, pale pink, more intensely coloured along the midrib; **Fr** erect, 10 - 12 mm; **Se** oblong, tapering at the tip, 1 mm. – [H. 't Hart & V. V. Byalt]

P. ferganense ssp. **parvum** Kamelin & Byalt (Komarovia 1: 39-40, 1999). **T:** Kirgizia (Kamelin & al. 969 [LE]). – **D:** Kirgizia (W Tien Shan Mts.: Ataynok and Chatkal Ranges); badlands, rocks and stony slopes, flowers April to May.

Differs from ssp. *ferganense*: Overall size smaller; flowering **Br** 2 - 5, 5 - 12 cm; **Inf** with fewer and smaller **Fl**. – [V. V. Byalt]

P. kamelinii A. V. Palanov (Bot. Zhurn. (Moscow & Leningrad) 73(5): 717-719, 1988). **T:** (Palanov s.n. [LE]). – **D:** Tadzhikistan (W Pamir: Darvaz, Rushan and Shugnan ranges); stony and rocky mountain slopes, flowers June to August.

Rhizome simple, 1 cm long with many fasciculate non-tuberous **R** with 2 mm $\varnothing$; **L** linear, 10 - 12 $\times$ to 1 mm; flowering **Br** 1 - 2, 15 - 30 cm; **Inf** corymbose-paniculate, 2 - 3 cm $\varnothing$; **Bra** narrowly linear, subobtuse, 2 mm; **Fl** 5- to 6-merous, subsessile or to 1 mm pedicellate; **Sep** oblong-triangular, obtuse, 2.5 - 3 mm; **Cl** 9 - 10 mm long, basally tubular for 2 - 2.5 mm, lobes narrowly lanceolate, 6.5 - 8 mm, pink; **Fr** oblong, erect, 6 - 8 mm; **Se** oblong, obtuse, $\pm$ 0.5 mm. – [V. V. Byalt]

P. karatavicum Borissova (Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 7(8): 185-188, fig. 2: 1-4, 1938). **T:** Kazakhstan (Lipschitz 449 [LE]). – **D:** Kazakhstan (W Tien Shan Mts.: Kara Tau Range); stony and pebbly soils, flowers June to July.

Rhizome simple, 3 - 4 cm long, with branched robust **R**, producing numerous thickened lateral **R** with 0.4 - 0.5 mm $\varnothing$; **L** $\pm$ 5 $\times$ to 1 mm; flowering **Br** many, 5 - 10 cm; **Inf** compressed, few-flowered, $\pm$ 1.5 cm $\varnothing$; **Bra** lanceolate, subobtuse, 5 $\times$ 1 - 1.5 mm; **Ped** to 0.8 mm; **Fl** 5-merous, subsessile or shortly pedicellate; **Sep** linear-lanceolate, acute, 5 - 6 mm; **Cl** campanulate, $\pm$ 10 mm long, lobes broadly triangular, $\pm$ 6 mm, pink; **Fr** lanceolate, erect, 8 - 9.5 mm; **Se** oblong, 0.7 - 0.8 mm. – [H. 't Hart & V. V. Byalt]

P. koelzii C.-A. Jansson (in K. H. Rechinger (ed.), Fl. Iranica 72: 20, pl. 4, 1970). **T:** Iran, Lurestan (Koelz 15664 [W]). – **D:** W Iran; dry, stony slopes, 1650 - 1800 m, flowers April to May.

Rhizome thick with persistent old stems, ending in a thick simple **R**, 2 - 4 $\times$ $\pm$ 1 cm $\varnothing$; **L** linear to narrowly lanceolate, broadening towards the base, 5 - 12 $\times$ 1 - 2 mm; flowering **Br** 2 to many, 15 - 25 cm; **Inf** dense, corymbiform, flattened; **Ped** 2 - 6 mm; **Sep** oblong-ovate, obtuse, 3 - 5 mm; **Cl** tubular or campanulate, 13 - 15 mm long, lobes 6.5 - 7.5 mm, pink; **Fr** narrowly ovoid, (semi-) erect. – [H. 't Hart & V. V. Byalt]

P. lievenii (Ledebour) A. Berger (NPF2 18a: 465, 1930). **T:** Kazakhstan (Meyer s.n. in *Herb. Ledebour* 607 [LE]). – **D:** Russia (W Siberia: Altai foothills), C Asia: Kazakhstan (Caspian, Aral and Balkash deserts, Betpakdala, Mujunkum, Zaisan hollow, Dzungar and Transili Alatau, Chu-Ili Mts., Karatau), Kirgizia (Kungei, Kirgiz Alatau), Tadzhikistan (Mogoltau), Uzbekistan (Kyzyl Kum, Tashkent Alatau, W Pamir and Alai regions), W Mongolia, Tibet, W China (N Xinjiang); stony, clayey and saline soils, mostly around lakes in (semi-) deserts; flowers April to June. **I:** Fröderström (1931: figs. 308-316, pl. 27).

$\equiv$ *Cotyledon lievenii* Ledebour (1830) $\equiv$ *Umbilicus lievenii* (Ledebour) Ledebour (1843) $\equiv$ *Sedum lievenii* (Ledebour) Hamet (1929); **incl.** *Sedum indierense* Fischer ex O. & B. Fedtschenko (1911) (*nom. inval.*, Art. 34.1c).

Rhizome robust with many slender fascicular $\pm$ branched **R** to 2 mm $\varnothing$; **L** linear, 0.5 - 2 cm; flowering **Br** 1 to 4, 20 - 25 (-30) cm; **Inf** corymbiform, with approximate **Br**, elongated at **Fr** time; **Bra** oblong or lanceolate, $\pm$ 2 mm; **Ped** 1 - 2 mm; **Fl** 5- or 6-merous; **Sep** subacute, to 3 mm; **Cl** funnel-shaped or campanulate, 10 - 12 mm long, pink; **NSc** with cordate narrow base; **Fr** lanceolate, 7 - 10 mm; **Se** oblong-ovoid, tapering at the tip, 1 mm. – [H. 't Hart & V. V. Byalt]

P. longidentatum Borissova (Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 1(1): 109, fig. 2, 1933). **T:** Kazakhstan (Killoman s.n. [LE]). – **D:** C Asia (Dzhungar Alatau, Pamir and Alai regions, Tien Shan Mts.), NW, N and C Afghanistan; subalpine and alpine meadows, slopes among woody-shrubby vegetation, steppe slopes on pebbly soils, 900 - 3000 m, flowers April to May. **I:** Borissova (1955: 233, t. 25: fig. 6); Borissova (1975: 243, t. 47: figs. 1-2).

Incl. *Pseudosedum kuramense* Borissova (1966).

Rhizome robust with many thick fascicular **R** to 7 mm $\varnothing$; **L** linear, 5 - 20 $\times$ 1 - 2 mm; flowering **Br** 1 to 4, or many, 25 - 40 cm; **Inf** corymbose-paniculate, with elongated **Br** at **Fr** time; **Bra** 2 - 4 mm; **Ped** 2 - 5 mm; **Fl** 6-merous (rarely 5-merous); **Sep** subacute to ovate, 3 - 4 mm; **Cl** tubular, 12 - 14 mm

long, lobes lanceolate, 6 - 9 mm, colour not recorded; **Fr** lanceolate, erect; **Se** elongate, to 1 mm. – [H. 't Hart & V. V. Byalt]

P. multicaule (Boissier & Buhse) Borissova (Trudy Bot. Inst. Akad. Nauk SSSR, Ser. 1, Fl. Sist. Vyssh. Rast. 1(1): 112, fig. 6, 1933). **T:** Iran (*Buhse* 1433 [LE]). – **D:** C Asia: Turkmenistan (Kopet Dag Range), NW, N and E Iran; stony slopes and rocks, 1500 - 2800 m, flowers April to June. **I:** Borissova (1939: 82, pl. 6: fig. 2).

≡ *Umbilicus multicaulis* Boissier & Buhse (1860).

Rhizome well developed, sometimes branched, ± thickened and 5 - 10 mm Ø; **L** linear to linear-oblong, 4 - 20 × 1 - 3 mm; flowering **Br** 7 or more, (7-) 10 - 20 (-25) cm; **Inf** umbellate-corymbiform, with arcuate forked **Br** 1.5 - 2 cm long; **Bra** 3 - 4 × to 1.5 mm; **Ped** thickish, 3 - 6 mm; **Sep** oblong, obtuse, 3 - 5 × ± 1 mm; **Cl** campanulate or ventricose, 10 - 12 mm long, lobes ovate, 6 mm, pale red to pink; **Fr** semi-erect, 10 - 12 mm; **Se** oblong, 1 mm. – [H. 't Hart & V. V. Byalt]

RHODIOLA

H. Ohba

Rhodiola Linné (Spec. Pl. [ed. 1], 1035, 1753). **T:** *Rhodiola rosea* Linné [Typification by inference, only element included.]. – **Lit:** Ohba (1978); Ohba (1980); Ohba (1981a); Ohba (1982a). **D:** Europe, Siberia, E Asia, N America; esp. subarctic and alpine zones. **Etym:** Gr. 'rhodon', rose; and Lat. diminutive suffix '-iola'; the roots have the scent of roses.

Incl. *Rhodia* Adanson (1763) (*nom. illeg.*, Art. 52.1). **T:** *Rhodiola rosea* Linné.

Incl. *Tetradium* Dulac (1867) (*nom. illeg.*, Art. 53.1). **T:** *Rhodiola odorata* Lamarck [Typification by inference, only element included.].

Incl. *Clementsia* Rose (1903). **T:** *Sedum rhodanthum* A. Gray [Typification by inference, only element included.].

Incl. *Chamaerhodiola* Nakai (1934). **T:** *Sedum quadrifidum* Pallas.

Incl. *Kirpicznikovia* A. Löve & D. Löve (1976) (*nom. illeg.*, Art. 52.1). **T:** *Sedum quadrifidum* Pallas.

Incl. *Tolmachevia* A. Löve & D. Löve (1976). **T:** *Rhodiola integrifolia* Rafinesque.

Perennial herbs with well developed rhizomes; rhizomes massive or slender, erect to creeping, apical part with foliage and/or scaly **L**; **L** alternate, simple, herbaceous (to ± fleshy), mostly flat; flowering stems arising from the **Ax** of the scaly or, rarely, foliage radical **L**, annual, sometimes persistent for a while, unbranched, with terminal **Inf**; **Inf** usually cymose or reduced to a solitary **Fl**, or rarely ra-

cemose, mostly bracteate; **Bra** leafy; **Fl** bisexual or unisexual (plants then almost always dioecious, rarely monoecious), 4- to 5- (to 6-) merous, pedicellate, obdiplostemonous; when dioecious: **Pet** and **Ov** opposite in male but alternate in female plant; when bisexual or monoecious: **Pet** and **Ov** always opposite; **Cal** fleshy, in the female plant forming a tube divided into 4 - 5 (-6) ± equal lobes; **Pet** free, white, reddish, deep purplish-red or pale yellow to greenish, always longer than the **Sep** in female plants; **Anth** mostly basifixed (dorsifixed in *R. hobsonii*); **NSc** linear-oblong to semicircular; **Ca** superior to half-inferior, usually basally united (rarely completely free), sessile, straight at anthesis, slightly patent at fruiting time, dorsally rounded; **Sty** slender; **Sti** terminal, papillate, swollen at the tip; ovules anatropous; **Fr** dry follicles; **Se** < 3 mm, ± fusiform, brownish, longitudinally striate.

The genus was traditionally united with *Sedum*, but is quite distinct in its gross morphology and the fleshy rhizomes with scale leaves, as well as the often unisexual flowers. The following subgenera and sections are recognized:

[–] Subgen. *Primuloides* (Praeger) H. Ohba 1978: Foliage or dimorphic scaly radical **L** present; **Fl** hermaphrodite; **Ov** ± superior:

[1] Sect. *Hobsonia* (H. Ohba) H. Ohba 1978: Radical **L** not scaly, caducous; **Inf** helicoid cymes; **Anth** dorsifixed.

[2] Sect. *Primuloides* (Praeger) S. H. Fu 1965: Radical **L** not scaly, persistent; **Inf** dichasial cymes; **Anth** basifixed.

[3] Sect. *Smithia* (H. Ohba) H. Ohba 1978: Radical **L** scaly, dimorphic; **Inf** dichasial cymes; **Anth** basifixed.

[4] Subgen. *Crassipedes* (Praeger) H. Ohba 1978: Foliage and dimorphic scaly radical **L** absent; **Inf** cymose, or compound-cymose or fasciculate-cymose, semiglobose; **Fl** hermaphrodite (rarely plants monoecious); **Ov** ± superior.

[5] Subgen. *Clementsia* (Rose) H. Ohba 1978: Foliage and dimorphic scaly radical **L** absent; **Inf** racemose, elongate; **Fl** hermaphrodite; **Ov** ± superior.

[–] Subgen. *Rhodiola*: **Fl** unisexual and plants dioecious; female **Fl** with **Cal** forming a tube; **Ov** ± half-inferior.

[6] Sect. *Pseudorhodiola* (Diels) H. Ohba 1978: **L** in verticils of 3 or 4; **Inf** large, paniculate.

[7] Sect. *Rhodiola*: **L** > 10, alternate; **Inf** cymose, usually with many **Fl**.

[8] Sect. *Prainia* (H. Ohba) H. Ohba 1978: **L** 4 - 6, nearly verticillate; **Inf** cymose, usually 3- to 18-flowered.

[9] Sect. *Chamaerhodiola* (Fischer & C. A. Meyer) Borissova 1939: Flowering stems withering but persistent for some time, usually fastigiate; lower ½ of **Ca** in female **Fl** embedded in the **Cal** tube.

The following names are of unresolved application but are referred to this genus: *Rhodiola lanceolata* Hort. Edinburgh ex Praeger (1921) (*nom. inval.*, Art. 34.1a); *Sedum hypericifolium* Wallich (1828) (*nom. inval.*, Art. 32.1c); *Sedum trollii* Werdemann (1939).

R. algida (Ledebour) Fischer & C. A. Meyer (Enum. Pl. Nov. Schrenk 1: 70, 1841). **T:** Siberia (*Ledebour* s.n. [LE, BM]). – **D:** Russia (Siberia: Altai Mts.), N Mongolia, N China (Inner Mongolia).

≡ *Sedum algidum* Ledebour (1830) ≡ *Chamaerhodiola algida* (Ledebour) Nakai (1934); **incl.** *Sedum euphorbioides* Schlechtendal ex Ledebour (1843) ≡ *Sedum algidum* var. *euphorbioides* (Schlechtendal ex Ledebour) Hamet (1929) ≡ *Chamaerhodiola euphorbioides* (Schlechtendal ex Ledebour) Nakai (1934); **incl.** *Sedum algidum* var. *altaicum* Maximowicz (1883); **incl.** *Sedum algidum* var. *jeniseense* Maximowicz (1883).

[4] Hermaphrodite, to 18 cm tall; rhizome massive, branched; flowering stems 1 - 3, persistent for 1 year after fruiting, 2 - 3 mm Ø, glabrous, smooth; **L** scattered, sessile, thickly herbaceous, 8 - 20 × 1.5 - 3 mm, linear to linear-lanceolate, entire, tip acute, abruptly acuminate, base round-truncate to round, ascending, glabrous, smooth; **Inf** 30- to 60-flowered, compact, 1 - 2 cm long; **Ped** 2 - 3 mm; **Cal** glabrous, tube 0.8 - 1.2 mm, lobes lanceolate to linear-lanceolate, 3 - 4 mm; **Pet** linear-lanceolate, 7 - 8 mm; **St** distinctly shorter than the **Pet**, ± 5 mm; **Ca** 4 mm; **Sty** < 1 mm.

R. alsia (Fröderström) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 121, 1965). **T** [lecto]: China, Yunnan (*Smith* 10571 [UPS]). – **D:** China, Tibet.

≡ *Sedum alsium* Fröderström (1942).

R. alsia ssp. *alsia* – **D:** Tibet, China (NW Sichuan, Yunnan); *Rhododendron* forests, rocky slopes, 3400 - 4800 m. **I:** Ohba (1981a: 104). **Fig. XXVII.d**

Incl. *Sedum doratocarpum* Fröderström (1942).

[7] Gynodioecious, to 20 cm tall; rhizomes cylindrical, to 15 mm Ø; flowering stems 2 - 6, 2 - 3 mm Ø, persistent for 1 year after fruiting, often red-purplish, glabrous, smooth; **L** scattered, sessile, ± ascending, linear to very narrowly elliptic, 8 - 18 × 2 - 3 mm, glabrous, smooth, tip round to obtuse, base attenuate to round, margin usually entire; **Inf** compactly 20- to 50-flowered, 2 - 3 cm long and wide; **Ped** < 2 mm, smooth; **Fl** 7 - 10 mm (hermaphrodite) or 5 - 7 mm (female) Ø; **Cal** 3.2 - 3.8 mm (hermaphrodite) or 4 - 5 mm (female), tube ± 1 mm, lobes linear to linear-subulate, 2.2 - 2.7 mm (hermaphrodite) or 2.6 - 3.5 mm (female); **Pet** narrowly oblong-oblancheolate to narrowly oblong (hermaphrodite) or linear to narrowly oblong (female), 5.5 - 6.8 mm (hermaphrodite) or 5 - 6 mm (female), ascending (hermaphrodite) or suberect (female); **St** longer than the **Pet**; **Fil** 6.5 - 8 mm; **Anth** reddish

(?); **NSc** broadly oblong-ovate to square, 0.8 - 1.1 mm; **Ca** 7 - 8 mm (hermaphrodite) or 11 - 13 mm (female), ventral side straight, tapering; **Sty** ± 1 mm (hermaphrodite) or 1.5 mm (female); ovules 6 - 8 in each follicle; **Se** 3.3 - 3.5 mm, brown, with low longitudinal ridges.

Sedum stamineum, here included as a synonym, would have priority and *R. alsia* should be proposed for conservation.

R. alsia ssp. *kawaguchii* H. Ohba (Acta Phytotax. Geobot. 32(5/6): 192-195, ill., 1981). **T:** Tibet (*Kawaguchi* s.n. [TNS]). – **D:** Tibet; rocky slopes, 4400 - 4600 m. **I:** Ohba (1981a: 193-194).

[7] Differs from ssp. *alsia*: Flowering stems tall, 20 - 25 cm × 1 - 1.8 mm Ø, fastigiate, densely leafy; bisexual **Fl** small, 5 - 7 mm Ø; **Se** shorter, 2.4 - 2.6 mm.

R. amabilis (H. Ohba) H. Ohba (J. Jap. Bot. 51(12): 386, 1976). **T:** Nepal (*Kanai & al.* 726008 [TI]). – **D:** Nepal; flowers mid-August to late September. **I:** Ohba (1980: 393).

≡ *Sedum amabile* H. Ohba (1976).

[4] Hermaphrodite, to 10 cm tall; rhizomes 3 - 10 mm Ø, sparsely branched; flowering stems 5 - 15, ± fastigiate, glabrous, pale green, 0.6 - 1 mm Ø; **L** densely arranged throughout, widely spreading, sessile, thickly herbaceous, linear to linear-lanceolate, 6 - 12 × 0.8 - 1.5 mm, tip round or obtuse, entire or nearly so; **Inf** 1- to 3- (to 5-) flowered; **Bra** 3 - 5 × 0.5 - 1 mm; **Ped** ± 0 - 1.2 mm; **Fl** 6 - 10 mm Ø; **Cal** 4.5 - 5.5 mm, glabrous, lobes 4 - 5 mm, triangular-lanceolate, tinged with red; **Pet** white or pink near tip, glabrous, spreading at anthesis, (narrowly) elliptic, 5 - 7.5 mm, acute or obtuse, entire; **St** distinctly shorter than the **Pet**, ascending to erect; **Anth** purplish-red; **NSc** broadly oblong to square, 0.6 - 1 mm long, mostly pale yellow; **Ca** 5 - 6 mm with 12 - 18 ovules each; **Sty** 1.5 mm.

R. angusta Nakai (Bot. Mag. (Tokyo) 28: 304, 1914). **T** [lecto]: Korea (*Mori* 44 [TI]). – **D:** E Russia, N China (Heilongjiang), N Korea; alpine grasslands, rocks, 1700 - 2600 m, flowers late June to mid-August. **I:** Ohba (1981a: 109).

≡ *Sedum angustum* (Nakai) Nemoto (1936) (*nom. illeg.*, Art. 53.1); **incl.** *Rhodiola ramosa* Nakai (1914); **incl.** *Sedum fenzelii* Fröderström (1936); **incl.** *Rhodiola komarovii* Borissova (1939) ≡ *Sedum komarovii* (Borissova) Chu (1959); **incl.** *Sedum ohbae* Kozhevnikov (1989).

[7] Dioecious, to 14 cm tall; rhizomes slender, sometimes branching, often surculose; flowering stems 2 - 5, 1.2 - 2 mm Ø, glabrous, nearly smooth; **L** densely arranged throughout, ascending to spreading, sessile, linear to linear-elliptic, 7 - 16 × 2 - 4 mm, glabrous, nearly smooth, tip truncately rounded to obtuse, base rounded truncate, margin entire to sparsely and irregularly crenulate; **Inf**

compactly 30- to 60-flowered, 1 - 1.7 × 1.2 - 3.5 cm Ø; **Ped** < 2 mm, smooth; **Cal** 3.5 - 5 mm, smooth, lobes linear, 2.5 - 3.1 mm (male) or 3 - 4.5 mm (female); **Pet** creamy-yellow, narrowly spatulate (male) or linear to linear-subulate (female), 4.8 - 5.5 mm (male) or 4.5 - 5 mm (female); **St** 4 - 6 mm; **Anth** purplish-red; **Ca** 5 - 8 mm, each with 10 - 14 ovules, ventral side straight; **Sty** (0.8-) 1 - 1.2 mm; **Fr** to 12 mm; **Se** linear, 2.5 - 2.7 mm, tailed, brown, with low longitudinal ridges.

R. atsaensis (Fröderström) H. Ohba (J. Jap. Bot. 51(12): 386, 1976). **T**: Tibet (*Kingdon-Ward* 6161 [K]). – **D**: E Himalaya: India, Tibet; scree slopes, 4500 - 4900 m. **I**: Ohba (1981a: 118).

≡ *Sedum atsaense* Fröderström (1943).

[7] Dioecious, to 10 cm tall; rhizomes slender, cylindrical, 5 - 10 mm Ø; flowering stems 2 - 3, 0.8 - 1 mm Ø, glabrous; **L** sessile, spatulate, 12 - 24 × 2.5 - 4 mm, entire, glabrous, spreading, tip round, base long attenuate; **Inf** 10- to 30-flowered; **Ped** to 1.5 mm, glabrous; **Fl** 4 - 8 mm Ø; **Cal** 5 - 14.5 mm, tube 2 - 5.5 mm, lobes spatulate, 2.5 - 9 mm; **Pet** inserted at the margin of the **Cal**-tube, spatulate, 2 - 7 mm, reddish-brown; **NSc** transversely oblong, 0.5 - 0.6 mm long; **Ca** 3 - 11.5 mm, each with 2 ovules; **Sty** indistinguishable; **Fr** 5 - 15 mm; **Se** ellipsoid, 3 - 3.2 mm, brown, longitudinally striate.

R. atuntsuensis (Praeger) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 120, 1965). **T** [lecto]: China, Yunnan (*Kingdon Ward* 962 [E]). – **D**: E Tibet, N Myanmar, SW China (W Sichuan, NW Yunnan); forests, glacial valleys, rocks, gravel areas, 3100 - 5000 m. **I**: Ohba (1982a: 162).

≡ *Sedum atuntsuense* Praeger (1921) ≡ *Chamaerhodiola atuntsuensis* (Praeger) Nakai (1934) ≡ *Rhodiola nobilis* ssp. *atuntsuensis* (Praeger) H. Ohba (1982); **incl.** *Sedum concinnum* Praeger (1921) ≡ *Rhodiola concinna* (Praeger) S. H. Fu (1965); **incl.** *Sedum venustum* Praeger (1921) ≡ *Rhodiola venusta* (Praeger) S. H. Fu (1965); **incl.** *Sedum aporonticum* Fröderström (1944) ≡ *Rhodiola aporontica* (Fröderström) S. H. Fu (1965); **incl.** *Sedum brevipetiolatum* Fröderström (1944) ≡ *Rhodiola brevipetiolata* (Fröderström) S. H. Fu (1965).

[9] Dioecious, 4 - 12 cm tall; rhizomes nearly cylindrical, to 1 cm Ø; flowering stems 1.2 - 1.5 mm Ø, smooth, not umbellately verticillate in age, ascending; **L** narrowly obovate to oblong, 4 - 8 × 1.6 - 3 mm, tip round, base (shortly) attenuate, margin entire to sparsely and irregularly crenulate; **Inf** 4- to 20-flowered; **Cal** 3 - 4.5 mm, smooth, lobes very narrowly oblong to subulate, 1.8 - 3 mm; **Pet** narrowly oblong to oblong, 3.5 - 4.5 mm (male) or 2.8 - 3 mm (female), creamy or pale pink; **St** longer than the **Pet**; **NSc** narrowly oblong to oblong, 0.7 - 1.2 mm; **Ca** 5 - 7 mm (female) [or 4 - 5 mm (male)], each with ± 6 ovules; **Se** ± 1.5 mm, linear.

R. atuntsuensis is distinguished from *R. nobilis*

by its densely fastigiate straight flowering stems, by the narrowly obovate to oblong leaves and by the more numerous flowers per inflorescence.

R. bupleuroides (Wallich ex Hooker fil. & Thomson) S. H. Fu (Acta Phytotax. Sin. 10 (Addit. 1): 124, 1965). **T**: Nepal (*Wallich* 7229 [K, BM, CAL]). – **D**: E Himalaya, Tibet, Myanmar, China.

≡ *Sedum bupleuroides* Wallich ex Hooker fil. & Thomson (1858).

R. bupleuroides var. **bupleuroides** – **D**: E Himalaya (India [Kumaon], Nepal, Sikkim, Bhutan), Tibet, Myanmar, SW China. **I**: Praeger (1921a: 48, as *Sedum*).

Incl. *Sedum cooperi* Praeger (1919) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum gorisii* Hamet (1929).

[7] Dioecious, variable in size, 15 - 50 cm tall; rhizomes cylindrical, 1 - 2 cm Ø; flowering stems 1 - 2, glabrous; **L** sessile, narrowly ovate to ovate or obovate, 1 - 6 × 0.4 - 4.5 cm, glabrous, tip round or obtuse, base cordate, margin entire; **Inf** 7- to 40-flowered; **Ped** 0.2 - 1 cm, glabrous; **Fl** 4 - 7 mm Ø; **Cal** 1.6 - 8 mm, glabrous, purplish-red, lobes 0.8 - 6 mm, narrowly oblong or oblong-ovate; **Pet** dark purplish-red, obovate to lanceolate (male), narrowly oblong or narrowly oblong-ovate (female), 2.8 - 4 mm (female), spreading to somewhat reflexed (male) or ascending to spreading (female); **St** usually as long as the **Pet**; **Fl** purplish-red, 3 - 4 mm; **Anth** dark or dull purplish-red; **NSc** oblong, glossy, dark purplish or blackish-red, 0.6 - 1.2 mm; **Ca** 3.5 - 9 mm with 10 - 16 ovules each, uppermost part abruptly narrowing and conspicuously out-curved; **Sty** short, < 0.3 mm, usually dark purple-red; **Fr** 5 - 12 mm; **Se** reddish-brown, tip round, 1.8 - 2.5 mm.

Here belongs *Sedum discolor* Franchet in the sense of Praeger (1921a) (as to type = *Rhodiola discolor*).

R. bupleuroides var. **parva** (Fröderström) H. Ohba (in H. Ohba & Akiyama, Alpine Fl. Jaljale Himal, 26, 1992). **T**: Tibet (*Hingston Mt. Everest Exped.* 380 [K]). – **D**: Himalaya (Nepal to Bhutan), Tibet.

≡ *Sedum bupleuroides* var. *parvum* Fröderström (1943).

[7] Differs from var. *bupleuroides*: Flowering stems 2 - 5 cm tall; **L** ovate to oblong-ovate, 4 - 8 × 3 - 5 mm wide, tip round to obtuse, base cordate to truncate; **Fl** purple, 1 to few.

R. calliantha (H. Ohba) H. Ohba (J. Jap. Bot. 51(12): 386, 1976). **T**: Nepal (*Stainton* 4703 [BM, TI]). – **D**: Nepal, S Tibet; rocks on shady slopes, ± 3600 m. **I**: Ohba (1974: 324); Ohba (1975: 331); both as *Sedum*.

≡ *Sedum callianthum* H. Ohba (1974).

[7] Dioecious, to 20 cm tall; rhizomes cylindrical, 1.2 - 1.5 cm Ø; flowering stems 3 - 5, 1.7 - 2 mm

Ø, glabrous; **L** petiolate (petiole 2 - 3 mm), glabrous, lamina (narrowly) rhombic-ovate to elliptic, 2 - 4.2 × 0.5 - 2 cm, glabrous, tip obtuse or deltoid-obtuse, base attenuate, margin in upper $\frac{3}{4}$ crenulate-serrate; **Inf** laxly 20- to 35-flowered; **Ped** 1.2 - 2.5 mm, glabrous; **Cal** 1.8 - 2.4 mm, lobes lanceolate to subulate, 1.3 - 2 mm; **Pet** purple, spreading, oblanceolate to obovate or elliptic, 3 - 4.5 mm; **St** mostly $\frac{3}{4}$ - $\frac{3}{4}$ as long as the **Pet**; **Fil** pale purplish, 2.5 - 3 mm; **Anth** deep purplish-red; **NSc** narrowly obovate, 0.8 - 1.2 mm; **Ca** 2 - 2.5 mm with 2 ovules each; **Sty** indistinguishable.

R. chrysanthemifolia (H. Leveillé) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 127, 1965). **T**: China, Yunnan (*Maire* s.n. [E, TI]). - **D**: Himalaya countries to SW China, Burma.

≡ *Sedum chrysanthemifolium* H. Leveillé (1931).

R. chrysanthemifolia ssp. *chrysanthemifolia* - **D**: Himalaya (Nepal, Sikkim, Bhutan, India [Assam]), Tibet, Myanmar, SW China; flowers late July to September. **I**: Praeger (1921a: 64, as *Sedum trifidum*). **Fig. XXVIII.b**

Incl. *Sedum trifidum* Wallich ex Hooker fil. & Thomson (1858) ≡ *Rhodiola trifida* (Wallich ex Hooker fil. & Thomson) H. Jacobsen (1973); **incl.** *Sedum trifidum* var. *balfourii* Hamet (1912) ≡ *Sedum linearifolium* var. *balfourii* (Hamet) Hamet (1913); **incl.** *Sedum trifidum* var. *forrestii* Hamet (1912) ≡ *Sedum linearifolium* var. *forrestii* (Hamet) Hamet (1913); **incl.** *Sedum dielsianum* H. Limpricht (1922) ≡ *Sedum linearifolium* var. *dielsianum* (H. Limpricht) Hamet (1926) ≡ *Rhodiola dielsiana* (H. Limpricht) S. H. Fu (1965); **incl.** *Sedum linearifolium* var. *ovatisepalum* Hamet (1926) ≡ *Rhodiola ovatisepala* (Hamet) S. H. Fu (1965) ≡ *Sedum ovatisepalum* (Hamet) H. Ohba (1975); **incl.** *Rhodiola ovatisepala* var. *chingii* S. H. Fu (1965).

[4] Hermaphrodite, 5 - 25 cm tall; rhizomes slender, creeping, to 20 cm, 2 - 5 mm Ø, sparsely branched with 1.5 - 3 mm long scaly **L**; flowering stems 2 - 4, glabrous, yellowish-green; **L** aggregated, widely spreading, sessile, yellowish-green, ovate to oblong-obovate, 1.5 - 8 × 0.2 - 2.3 cm, glabrous, tip obtuse to round, base long attenuate, densely papillate along the margins, margin in upper $\frac{1}{2}$ ± imparilobulate to sinuate, lobes 3 - 7, triangular to narrowly triangular, 2 - 12 × 0.8 - 6 mm, obliquely obtuse to round; **Inf** 30- to 40-flowered; **Ped** 4 - 10 mm, glabrous; **Fl** 8 - 18 mm Ø; **Cal** 1.7 - 2.5 (- 3.5) mm, glabrous, lobes ovate to triangular-ovate, 1.5 - 2.5 mm, tips and margins often reddish; **Pet** narrowly oblong-lanceolate, spreading, 6 - 7.5 × 1.1 - 1.3 mm, inner side white, outside pale greenish, often tinged with red, margin entire to somewhat erose; **St** whitish, 5 - 6.5 mm; **Anth** deep red-purple; **NSc** rectangular, 0.5 - 0.7 mm, yellow; **Ca** 5 - 7 mm, white with greenish shade, each with 8 - 14 ovules.

R. chrysanthemifolia ssp. *liciae* (Hamet) H. Ohba (Acta Phytotax. Geobot. 38: 216, 1987). **T** [syn]: China, Yunnan (*Ducloux* 2269+2805 [P]). - **D**: SW China (Yunnan).

≡ *Sedum licae* Hamet (1909) ≡ *Rhodiola licae* (Hamet) S. H. Fu (1965).

[4] Differs from the other ssp.: **L** orbicular or widely obovate; **Se** relatively large, 1.3 - 1.4 mm.

R. chrysanthemifolia ssp. *sacra* (Hamet) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 12: 384, 1980). **T**: Tibet (*Prair* s.n. [K, CAL]). - **D**: Nepal, Tibet. **I**: Ohba (1975: 342, as *Sedum*).

≡ *Sedum linearifolium* var. *sacrum* Hamet (1926) ≡ *Rhodiola sacra* (Hamet) S. H. Fu (1965) ≡ *Sedum sacrum* (Hamet) H. Ohba (1974); **incl.** *Sedum tieghemii* Hamet (1908) ≡ *Sedum linearifolium* var. *tieghemii* (Hamet) Hamet (1926) ≡ *Rhodiola tieghemii* (Hamet) S. H. Fu (1965); **incl.** *Rhodiola tsuiana* S. H. Fu (1965) ≡ *Rhodiola sacra* var. *tsuiana* (S. H. Fu) S. H. Fu (1985); **incl.** *Rhodiola alterna* S. H. Fu (1979).

[4] Differs from the other ssp.: **L** scattered throughout the flowering stem; **Cal** lobes oblong to oblong-ovate, 3.5 - 5 × 1.1 - 1.4 mm, papillate; **Pet** usually oblanceolate, 5 - 7 × 1.1 - 2 mm.

Rhodiola tieghemii is placed here in synonymy with a question mark.

R. chrysanthemifolia ssp. *sexfolia* (S. H. Fu) H. Ohba (J. Jap. Bot. 57(3): 84, 1982). **T**: Tibet (*Tsui* 5711 [PE]). - **D**: Tibet, China (W Szechuan). **I**: Ohba (1982a: 83).

≡ *Rhodiola sexfolia* S. H. Fu (1965).

[4] Differs from the other ssp.: **L** in whorls of ± 6 at 1 or 2 nodes of flowering stems; **Cal** lobes linear, papillate, base triangular-ovate, to 3.7 - 4.5 × 1.2 - 1.5 mm.

The subspecific epithet was originally spelled 'sexfolia'.

R. coccinea (Royle) Borissova (in Komarov & al. (eds.), Fl. URSS 9: 41, 1939). **T**: India, Kashmir (*Royle* s.n. [K, LE]). - **D**: C Asia, Afghanistan, Himalaya to SW China.

≡ *Sedum coccineum* Royle (1835) ≡ *Sedum quadrifidum* ssp. *coccineum* (Royle) J. P. Kozhevnikov (1988).

R. coccinea ssp. *coccinea* - **D**: Afghanistan, Bhutan, NW India, Kashmir, Nepal, Tibet, China (Gansu, Qinghai, Sichuan, Xinjiang); alpine regions, stony soils and rocks, 2600 - 4900 m, flowers late June to August. **I**: Ohba (1982a: 154). **Fig. XXVII.e**

Incl. *Rhodiola asiatica* D. Don (1825) ≡ *Sedum asiaticum* (D. Don) De Candolle (1828) ≡ *Chamaerhodiola asiatica* (D. Don) Nakai (1934); **incl.** *Sedum juparensis* Fröderström (1935) ≡ *Rhodiola juparensis* (Fröderström) S. H. Fu (1965).

[9] Dioecious, cushion-forming, 1 - 5 cm tall; rhizomes thick, basally tapering into carrot-like slender **R**, **Br** of rhizomes 0.5 - 8 × 1 - 3 cm Ø; flowering stems 5 - 10 from each rhizome **Br**, fastigiate, glabrous, ± 1 mm Ø, marcescent, straw-yellow or brownish; **L** ± flat, widely spreading, sessile, linear to linear-elliptic, 3 - 7 × 0.6 - 1.2 mm, glabrous, smooth, tip round to obtuse, base attenuate, margin entire; **Inf** dichasia but sometimes reduced to a single terminal **Fl**; **Ped** < 2 mm, smooth; **Fl** 4-merous, 3 - 4 mm Ø; **Cal** 2.5 - 3.5 mm, fleshy, glabrous, tube funnel-shaped, 0.6 - 1.2 mm, lobes linear-ovate to subulate, 1.4 - 2.5 mm; **Pet** red or yellow, oblong-ovate to narrowly oblong-ovate, 2.5 - 3.5 mm, spreading (male) or suberect to spreading (female); **St** as long as or longer than the **Pet**, ascending to suberect; **Anth** red; **NSc** narrowly oblong to oblong-subulate, yellow, 0.6 - 1.3 mm; **Ca** 4 - 6 mm (1.5 - 2 × as long as the **Pet**) (female) [or 2 - 3.5 mm (male)], with ± 6 ovules each; **Fr** 6 - 7 mm, erect, red-brown; **Se** elliptic, 1.6 - 1.8 mm, tip round, terminally ± winged, bright brown, longitudinally striate.

R. coccinea ssp. **scabrida** (Franchet) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(2): 153, 1982). **T**: China, Yunnan (*Delavay* s.n. [P]). - **D**: E Himalaya (Sikkim), E Tibet, SW China (W Sichuan, NW Yunnan); rock crevices, 2200 - 5300 m. **I**: Ohba (1982a: 144).

≡ *Sedum scabridum* Franchet (1896) ≡ *Chamaerhodiola scabrida* (Franchet) Nakai (1934) ≡ *Rhodiola scabrida* (Franchet) S. H. Fu (1965); **incl.** *Sedum likiangense* Fröderström (1935) ≡ *Rhodiola likiangensis* (Fröderström) S. H. Fu (1965); **incl.** *Sedum brachystylum* Fröderström (1942).

[9] Differs from ssp. *coccinea*: Flowering stems purplish-red, densely papillate to scabrid, 3 - 5 cm tall; **L** linear, 3 - 9 × 0.6 - 1.5 mm, tip obtuse, acute or acuminate; **Inf** 1- to 4-flowered; **Fl** 5-merous, purplish-red; **Ca** 3 - 5 mm with 6 - 12 ovules each; **Fr** 6 - 8 mm; **Se** 2 - 2.5 mm, linear, brown, winged.

R. crenulata (Hooker fil. & Thomson) H. Ohba (J. Jap. Bot. 51(12): 386-387, 1976). **T**: Sikkim (*Hooker* s.n. [K]). - **D**: Nepal, Sikkim, Bhutan, Tibet, China (Qinghai, Sichuan, Yunnan); tickets, grassland slopes, schist on mountain slopes, rocky places, rock crevices, 2800 - 5600 m, flowers June to July. **I**: Ohba (1975: 310, as *Sedum*). **Fig.** XXVII.f, XXVII.g

≡ *Sedum crenulatum* Hooker fil. & Thomson (1858); **incl.** *Sedum rotundatum* Hemsley (1896) ≡ *Sedum bupleuroides* var. *rotundatum* (Hemsley) Fröderström (1930) ≡ *Rhodiola rotundata* (Hemsley) S. H. Fu (1965); **incl.** *Sedum rotundatum* var. *oblongatum* C. Marquand & Shaw (1929); **incl.** *Sedum euryphyllum* Fröderström (1931) ≡ *Rhodiola euryphylla* (Fröderström) S. H. Fu (1965); **incl.** *Sedum megalanthum* Fröderström (1935); **incl.** *Sedum*

megalophyllum Fröderström (1942) ≡ *Rhodiola megalophylla* (Fröderström) S. H. Fu (1965).

[7] Dioecious, to 21 cm tall; rhizomes thick, subcylindrical, 2 - 2.5 cm Ø; flowering stems usually fastigiate, robust, 7 - 9 mm Ø, glabrous, waxy yellowish-green or pinkish, later turning ruddy-brown, lower parts remaining for 1 year after fruiting and becoming dark purplish-brown, often glossy; **L** petiolate, petioles 0.8 - 2 × 1.7 - 2 mm Ø, ± compressed, lamina glabrous, widely elliptic, elliptic or oblong-elliptic, 10 - 33 × 5.5 - 17 mm, tip round, base round or obtuse, margin minutely crenulate to erose, rarely nearly entire; **Inf** 20- to 40-flowered, dense, compact, 1.5 - 2 × 1.5 - 2.5 cm Ø; **Ped** glabrous, 3 - 5 mm; **Cal** 4 - 9 mm, lobes 2.6 - 6 mm, linear to linear-elliptic; **Pet** oblong-ovate or obovate to angularly obovate, 4.5 - 7 mm, bright crimson or reddish-purple; **St** slightly longer than the **Pet**; **Fil** 4 - 6.5 mm; **Anth** purplish-red; **NSc** oblong, 0.8 - 1.2 mm, reddish; **Ca** 7 - 10 mm with 8 - 12 ovules each, tapering into indistinct **Sty**; **Fr** dirty red or brown, 12 - 13 mm; **Se** reddish-brown, 2 - 2.3 mm, ellipsoid.

R. cretinii (Hamet) H. Ohba (J. Jap. Bot. 51(12): 386, 1976). **T** [lecto]: Sikkim (*Smith & Cave* 1206 [CAL, LYD]). - **D**: E Himalaya to China.

≡ *Sedum cretinii* Hamet (1916) ≡ *Sedum crassipes* var. *cretinii* (Hamet) Fröderström (1930) ≡ *Chamaerhodiola cretinii* (Hamet) Nakai (1934) ≡ *Sedum wallichianum* var. *cretinii* (Hamet) H. Hara (1966) ≡ *Rhodiola crassipes* var. *cretinii* (Hamet) H. Jacobsen (1973).

R. cretinii ssp. **cretinii** - **D**: E Himalaya: NE India (Assam), Nepal, Bhutan, Sikkim, Tibet; 3700 - 4100 m, flowers mid-June to August. **Fig.** XXVIII.c

[7] Dioecious, to 12 cm tall; rhizomes slender, creeping, surculose, 2 - 4 mm Ø; flowering stems 2 - 3, 0.7 - 1.1 mm Ø, glabrous; **L** densely arranged, widely spreading, sessile, linear or very narrowly elliptic or linear-oblongate, 7 - 14 × 1.5 - 2.8 mm, tip acute or obtuse, base long-attenuate, entire or very minutely crenulate along the margins, glabrous, sometimes reddish in the apical part; **Inf** 3- to 20-flowered, ± 2 × 3 cm Ø; **Ped** 1 - 5 mm; **Cal** 3.5 - 5.5 mm, glabrous, lobes subulate or linear, 2.8 - 4.5 mm; **Pet** greenish or yellowish-white, very narrowly elliptic or linear-oblongate, 3.5 - 6 mm, ascending; **St** slightly longer than the **Pet**; **Fil** 5 - 7 mm; **Anth** dark purplish-red; **NSc** broadly oblong, 0.6 - 0.9 mm, pale yellow to yellowish-orange; **Ca** 5 - 7 mm, tapering; **Fr** 7 - 10 mm; **Se** 1.6 - 1.9 × 0.5 - 0.7 mm.

R. cretinii ssp. **sino-alpina** (Fröderström) H. Ohba (J. Jap. Bot. 52(9): 264-266, 1977). **T**: China, Yunnan (*Handel-Mazzetti* 9752 [W, E]). - **D**: China (NW Yunnan); 4300 - 4400 m. **I**: Ohba (1981a: 116).

≡ *Sedum rosea* var. *sino-alpinum* Fröderström (1931) ≡ *Rhodiola sino-alpina* (Fröderström) S. H. Fu (1965).

[7] Differs from ssp. *cretinii*: Flowering stems 2 - 5 cm tall; **L** elliptic to oblong-spatulate, entire, 5 - 9 × 3.2 mm; **Inf** 1- to 5-flowered.

R. discolor (Franchet) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 124, 1965). **T**: China, Yunnan (*Dela-vay* 3771 [P]). – **D**: Nepal, Sikkim, SE Tibet, SW China (W Sichuan, NW Yunnan); forests, grassy slopes, rocky cliffs, 2800 - 4300 m, flowers mid-June to mid-August. **I**: Ohba (1975: 329, as *Sedum*). **Fig. XXVIII.a**

≡ *Sedum discolor* Franchet (1896) ≡ *Sedum bu-pleuroides* var. *discolor* (Franchet) Fröderström (1930).

[7] Dioecious, to 25 cm tall; rhizomes cylindrical, elongate, 0.7 - 1.4 cm Ø, branched; flowering stems 2 - 3 from each rhizome **Br**, smooth, glabrous, pale green, 1.5 - 2.5 mm Ø; **L** spreading, sessile, linear-ovate or narrowly oblong-elliptic, 9 - 25 × 2 - 4 mm, glabrous, lower face pale green and glaucous, near tip often reddish, tip acute, base truncate, margin remotely and irregularly denticulate; **Inf** 6- to 20-flowered; **Ped** glabrous; **Cal** 3.5 - 5 mm, glabrous, lobes triangular-lanceolate or subulate, 2.5 - 3 mm; **Pet** dark purplish-red or deep purple, oblong-elliptic to oblong-lanceolate (male), oblong to oblong-lanceolate (female), 5 - 6 mm (male) or 3 - 4 mm (female); **St** distinctly shorter than the **Pet**; **Fil** dark purplish-red or deep purple, 4.5 - 5.5 mm; **Anth** dark purple or dark purplish red; **NSc** oblong or square-ovate, 0.7 - 1.2 mm, conspicuously deep red-purple; **Ca** 7 - 9 mm with 10 - 14 ovules each, upper part abruptly outcurved ventrally; **Sty** short, 0.6 mm; **Fr** 8 - 10 mm, reddish-brown; **Se** narrowly ellipsoid, 2.5 - 3 mm.

R. dumulosa (Franchet) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 119, 1965). **T**: Mongolia (*David* 2288 [P]). – **D**: Bhutan, Myanmar, Mongolia?, W China (widespread); rocks on slopes, 1600 - 4100 m. **I**: Ohba (1980: 393).

≡ *Sedum dumulosum* Franchet (1883) ≡ *Chamaerhodiola dumulosa* (Franchet) Nakai (1934); **incl.** *Sedum rendlei* Hamet (1913) ≡ *Sedum dumulosum* var. *rendlei* (Hamet) Fröderström (1930); **incl.** *Sedum rariflorum* N. E. Brown (1914); **incl.** *Sedum farreri* W. W. Smith (1916) ≡ *Rhodiola dumulosa* fa. *farreri* (W. W. Smith) H. Jacobsen (1973); **incl.** *Chamaerhodiola wulingensis* Nakai (1934) ≡ *Sedum wulingense* (Nakai) Kitagawa (1939) ≡ *Rhodiola wulingensis* (Nakai) Kitagawa (1979); **incl.** *Sedum talihsienense* Fröderström (1936).

[4] Hermaphrodite, to 15 cm tall; rhizomes cylindrical or carrot-shaped, to 1 cm Ø, sparsely branched, buds conspicuous from late anthesis onwards, ovoid to ellipsoid, 5 - 10 mm long; flowering stems 5 - 10, ± fastigiate, simple, glabrous; **L** den-

sely arranged, ascending to spreading, sessile, linear to linear-lanceolate to -elliptic, 10 - 16 (- 22) × 1.5 - 2.5 mm, thickly herbaceous, glabrous, tip obtuse, margin entire or nearly so; **Inf** 4- to 20-flowered; **Ped** 1 - 3 mm; **Fil** 6 - 8 mm Ø; **Cal** 6 - 7.5 mm, glabrous, lobes subulate to linear-subulate, 3 - 4.5 mm; **Pet** oblong to oblanceolate or narrowly obovate, greenish-white to creamy, erect to suberect, tip acuminate, margin entire to densely erose, 8 - 11 mm; **St** distinctly shorter than the **Pet**, erect; **Anth** blackish-red; **NSc** transversely oblong to square, 0.6 - 0.8 mm; **Ca** 8 - 10 mm with 8 - 10 ovules each; **Fr** 10 - 15 mm; **Se** elliptic, ± 1.2 mm, winged at both ends, brown, longitudinally striate.

R. fastigiata (Hooker fil. & Thomson) S. H. Fu (Acta Phytotax. Sin. 10 (Addit. 1): 122, 1965). **T**: Sikkim (*Hooker* s.n. [K]). – **D**: Himalaya (Kashmir, India, Nepal, Sikkim, Bhutan), Tibet, SW China (Sichuan, Yunnan); rocky slopes, 3500 - 5400 m, flowers late June to August. **I**: Ohba (1975: 351, 353, as *Sedum*). **Fig. XXVIII.d**

≡ *Sedum fastigiatum* Hooker fil. & Thomson (1858) ≡ *Sedum quadrifidum* var. *fastigiatum* (Hooker fil. & Thomson) Fröderström (1930) ≡ *Chamaerhodiola fastigiata* (Hooker fil. & Thomson) Nakai (1934).

[9] Dioecious, 6 - 13 cm tall; rhizomes elongate, almost cylindrical, 2 - 3 cm Ø, sparsely branched; flowering stems 8 - 20, fastigiate, usually green, rarely reddish, 0.8 - 2 mm Ø, remains of old stems dark red or straw-coloured; **L** densely arranged throughout, spreading, sessile, linear-lanceolate or linear-oblanceolate or lanceolate, 8 - 12 × 1.2 - 1.5 mm, glabrous, tip round, base attenuate, margin nearly entire; **Inf** 6- to 17-flowered, 1 - 1.5 cm (male) or 1.5 - 2.5 cm (female) Ø; **Ped** 1 - 4 mm, often papillate; **Fil** mostly 5-merous (occasionally 4-merous), 4 - 8 mm Ø; **Cal** 2.8 - 4 mm, glabrous, lobes narrowly triangular-ovate or linear-lanceolate, 2.3 - 3.5 mm; **Pet** narrowly elliptic, linear-lanceolate or narrowly oblong, 3.5 - 6 mm, creamy-white or yellow, often reddish outside, ascending (male) or suberect (female); **St** slightly longer than the **Pet**; **Fil** creamy-white, often reddish, 4 - 6 mm; **Anth** red; **NSc** square or square-ovate, 0.6 - 0.8 mm, bright or deep yellow; **Ca** 6 - 8 mm, each with 14 - 16 ovules, tapering; **Sty** short, ± 1 mm; **Fr** 8 - 10 mm; **Se** narrowly oblong-ellipsoid with elongate tip, reddish or chestnut-brown, 1.5 - 2.5 mm.

R. gelida Schrenk ex Fischer & C. A. Meyer (Enum. Pl. Nov. Schrenk 1: 67-71, 1841). **T**: Siberia (*Schrenk* 692 [LE]). – **D**: E Russia, Tadzhikistan, Mongolia, China (Xinjiang); grassland slopes and rocks, 2800 - 4200 m. **I**: Ohba (1982a: 144).

≡ *Sedum gelidum* (Schrenk ex Fischer & C. A. Meyer) Karelin & Kirilow (1842) ≡ *Chamaerhodiola gelida* (Schrenk ex Fischer & C. A. Meyer) Nakai (1934); **incl.** *Sedum dubium* Paulsen (1922).

[9] Dioecious, 3 - 10 cm tall; rhizomes massive, basally continuous into a massive cylindrical **R**; rhizome **Br** cylindrical, 1 - 1.5 cm Ø; flowering stems fastigiate, ± 1 mm Ø, marcescent, glabrous; **L** alternate, laxly arranged, sessile, ascending to spreading, oblong to narrowly ovate, 6 - 10 $\times$ 2.3 - 4 mm, glabrous, smooth, tip round, base truncate, margin sparsely denticulate to nearly entire; **Inf** 4- to 10-flowered, 0.6 - 1.5 $\times$ 1 - 2 cm Ø; **Ped** < 1 mm, smooth; **Fl** 4-merous, 3 - 4 mm (male) or 4 - 5 mm (female) long; **Cal** 2.5 - 3.5 mm, tube ± 1 mm, lobes oblong to broadly oblong, 1.8 - 2.2 mm (male) or 2 - 2.5 mm (female); **Pet** yellow, oblong to oblong-ovate (male) or narrowly oblong (female), 3 - 4 mm (male) or 1.8 - 2.2 mm (female), ascending to suberect; **St** slightly longer than the **Pet** (male); **NSc** oblong to narrowly oblong, 1.1 - 1.3 mm; **Ca** 5 - 6 mm [± 3 mm (male)], each with ± 12 ovules.

R. gelida appears to be distinguishable from *R. quadrifida* by the oblong to narrowly ovate leaves with often roughly and irregularly denticulate margins, as well as by the oblong to broadly oblong calyx lobes.

R. handelii H. Ohba (J. Jap. Bot. 52(10): 307-308, 1977). **T**: China, Sichuan (*Handel-Mazzetti* 2674 p.p. [GB]). – **D**: SW China (Sichuan). **I**: Ohba (1980: 371).

$\equiv$ *Sedum handelii* (H. Ohba) R. Stephenson (1994) (*nom. inval.*, Art. 33.1, 33.2).

[2] Hermaphrodite, 1.5 cm tall; rhizomes cylindrical, 5 - 10 mm Ø, much branched; **Ros** with 20 - 40 **L**, 3 - 5 mm Ø, with the withering **L** of the previous year below the living **L**; radical **L** petiolate, spurred, annual but the petiolar part marcescent, petioles flat, 4 - 5.5 mm, longer than the lamina, ± 0.4 mm broad at the middle, broadening towards the base (1.5 - 1.7 mm), spur lunate, ± 0.6 mm, lamina flat, oblong, 1.5 - 3.5 (-4) $\times$ 0.8 - 1.7 mm, glabrous, tip round, margin entire, base tapering to petiole; scaly **L** triangular, brown, 1.6 - 2 $\times$ 2 - 2.5 mm; flowering stems glabrous; cauline **L** flat, sessile, spurless, spatulate to oblanceolate, 3.5 - 4 $\times$ 1 - 1.3 mm, glabrous, tip round, base long-attenuate, margin entire; **Inf** 1- (to 3-) flowered; **Fl** 4- or 5-merous, 3 - 3.5 mm Ø; **Sep** free, narrowly ovate to narrowly oblong-ovate, 3.2 - 3.7 mm, glabrous, conspicuously spurred, spur 3.2 - 3.7 mm; **Pet** triangular-ovate to oblong-ovate, 2.5 - 2.7 mm; **St** slightly shorter than the **Pet**; **Anth** reddish; **NSc** oblong, 1 - 1.2 mm, reddish; **Ca** 2.2 - 2.5 mm, each with 8 - 10 ovules.

R. heterodonta (Hooker fil. & Thomson) Borissova (in Komarov & al. (eds.), Fl. URSS 9: 32, 1939). **T**: Kashmir (*Thomson* s.n. [K]). – **D**: Afghanistan, Pakistan, Tadzhikistan, Kashmir, India (Kumaon), Nepal, Tibet, Mongolia, China (Xinjiang); slopes, sides of ravines, 2800 - 4700 m, flowers June to August. **I**: Praeger (1921a: 35, as *Sedum*). **Fig. XXVIII.e**

$\equiv$ *Sedum heterodontum* Hooker fil. & Thomson (1858) $\equiv$ *Sedum rosea* var. *heterodontum* (Hooker fil. & Thomson) Fröderström (1930).

[7] Dioecious, to 40 cm tall; rhizomes subcylindrical or narrowly ovoid, 2 - 3 cm Ø, sparsely branched, erect to suberect; flowering stems robust, pale green, somewhat glaucous, glabrous, 10 - 25 cm tall, 4 - 7 mm Ø, elongating after flowering to 25 - 40 cm, then 6 - 10 mm Ø; **L** $\pm$ well spaced, sessile, triangular-, pentagonal- or broadly pentagonal-ovate, 12 - 25 $\times$ 10 - 15 mm, tip acute or obtuse, base shallowly cordate to $\pm$ auriculate or rarely truncate, margin coarsely 2- to 6-toothed or repand to nearly entire, pale green, somewhat glaucous beneath; **Inf** very dense, compact, capitate, 80- to 120-flowered, mostly ebracteate, 1 - 2 $\times$ 2.5 - 3 cm Ø; **Fl** almost sessile; **Cal** 3 - 4.5 mm, glabrous, lobes linear, 2.5 - 4 mm, suberect; **Pet** very narrowly rhombic-elliptic to oblong (male) or linear (female), 3.5 - 4.5 mm (male) or 1.8 - 2.3 mm (female), yellowish or greenish-white, erect (male) or ascending (female); **St** distinctly longer than the **Pet**; **Fil** 5.5 - 9 mm; **Anth** dull purplish red; **NSc** oblong, 0.8 - 1.1 mm, orange-yellow; **Ca** 5 - 6 mm, each with 20 - 30 ovules; **Sty** short, < 0.6 mm; **Fr** 6 - 8 mm; **Se** nearly ellipsoid, 1.2 - 1.5 mm, round at the tip, brown.

Fu & Ohba (2001: 262) indicate that this taxon does also occur in Iran.

R. himalensis (D. Don) S. H. Fu (Acta Phytotax. Sin. 10 (Addit. 1): 121, 1965). **T**: Nepal (*Wallich* s.n. [BM]). – **D**: Himalaya countries to SW and C China.

$\equiv$ *Sedum himalense* D. Don (1825) $\equiv$ *Sedum quadrifidum* var. *himalense* (D. Don) Fröderström (1930) $\equiv$ *Chamaerhodiola himalensis* (D. Don) Nakai (1934).

R. himalensis ssp. *bouvieri* (Hamet) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(2): 137, 1982). **T**: Nepal (*Duthie* 5565 p.p. [DD, BM, K]). – **D**: W Nepal. **I**: Ohba (1975: 358, as *Sedum bouvieri*).

$\equiv$ *Sedum bouvieri* Hamet (1916) $\equiv$ *Sedum quadrifidum* var. *bouvieri* (Hamet) Fröderström (1930) $\equiv$ *Chamaerhodiola bouvieri* (Hamet) Nakai (1934) $\equiv$ *Rhodiola himalensis* var. *bouvieri* (Hamet) H. Jacobsen (1973) $\equiv$ *Rhodiola bouvieri* (Hamet) H. Ohba (1976).

[9] Differs from ssp. *himalensis*: **L** ovate, densely papillate, papillae 0.2 - 0.4 mm.

R. himalensis ssp. *himalensis* – **D**: Himalaya (Nepal, Sikkim, Bhutan), Tibet, SW China (NW Sichuan, Yunnan); forests, scrub, slopes, 3700 - 4200 m, flowers mid-June to August. **I**: Praeger (1921a: 52, as *Se-dum*). **Fig. XXVIII.f, XXVIII.g**

Incl. *Sedum coriaceum* Wallich ex Hooker fil. & Thomson (1858).

[9] Dioecious, to 50 cm tall; rhizomes cylindri-

cal, 2 - 4 cm Ø, to 40 cm long, creeping except the ascending upper part; flowering stems 12 - 25, fastigiate, reddish, densely papillate, the remains of old stems reddish-brown; **L** spreading, sessile, oblong-oblancheolate or narrowly elliptic, 6 - 20 × 2.5 - 7 mm, tip obtuse or acute, base attenuate, margin remotely and irregularly crenulate-denticulate or nearly entire, dark or deep green above, slightly glaucous or pale green beneath, densely papillate along margin; **Inf** 10- to 50-flowered, 2.5 - 4 cm (male) or 4 - 10 cm (female) Ø; **Ped** 0.8 - 3 mm, papillate, reddish; **Fl** 6 - 8 mm (male) or 4 - 5 mm (female) Ø; **Cal** 4 - 5.5 mm, glabrous, tube 2 - 3.5 mm, lobes 1.5 - 3 mm, narrowly triangular or subulate; **Pet** dark red-purple, oblong-ovate or narrowly oblong-ovate, 2.5 - 4.5 mm, spreading (male) or suberect (female); **St** shorter than the **Pet**; **Fil** 2 - 3 mm; **Anth** deep red-purple; **NSc** square or square-ovate, 0.7 - 0.9 mm, blackish-purple; **Ca** 4.5 - 5.5 mm, each with 10 - 14 ovules; **Sty** 0.5 mm; **Fr** 7 - 8 mm; **Se** ellipsoid with elongate tip, 2.5 - 3 mm, chestnut-brown.

R. himalensis ssp. **taohoensis** (S. H. Fu) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(2): 140, 1982). **T**: China, Gansu (*Taoho Exped.* 3340 [PE]). – **D**: China (S Gansu, Qinghai); shaded slopes, 2600 - 3800 m. **I**: Ohba (1982a: 144).

≡ *Rhodiola taohoensis* S. H. Fu (1965) ≡ *Sedum himalense* ssp. *taohoense* (Fu) J. P. Kozhevnikov (1989).

[9] Differs from ssp. *himalensis*: **L** very narrowly oblong to narrowly oblong, entire, papillae < 0.1 mm on both faces; **Cal** moderately papillate (to smooth).

R. hobsonii (Prain ex Hamet) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 118, 1965). **T**: Tibet (*Hobson* s.n. [K]). – **D**: Bhutan, Sikkim, Tibet; forests, thickets, rock crevices, 2600 - 4100 m, flowers late August to September. **I**: Hamet (1926: 331). **Fig. XXIX.e**

≡ *Sedum hobsonii* Prain ex Hamet (1913); **incl.** *Sedum praegeianum* W. W. Smith (1915); **incl.** *Sedum mirabile* H. Ohba (1974).

[1] Hermaphrodite, to 7 - 12 cm tall; rhizomes thick, 1 - 5 cm long, 1 - 1.5 cm Ø; radical **L** fleshy, deciduous, petiole 7 - 10 mm, flat, gradually broadening towards the base, 2 - 4 mm broad at the base, lamina lanceolate or linear-ovate, 7.5 - 10 × 3.2 - 4 mm, tip obtuse, margin entire; flowering stems 2 - 18, ascending, glabrous, 1 - 1.8 mm Ø; **L** spreading widely, sessile, spatulate to trullate or narrowly oblong-ovate, 6 - 15 × 2 - 4.5 mm, tip obtuse to round, base shortly attenuate, entire, glabrous; **Inf** helicoid cymes, 5- to 10-flowered, 0.7 - 3.5 × 1.2 - 4.5 cm Ø; **Fl** 7 - 9 mm Ø; **Cal** 4.4 - 7 mm, glabrous, lobes lanceolate or long-ovate, 3.5 - 5.2 mm; **Pet** lanceolate or oblong-elliptic, 5.5 - 7.6 mm, pink, nearly erect; **St** shorter than the **Pet**; **Fil** 5.2 - 6.3 mm; **Anth** dor-

sifixed, dehiscing longitudinally by 2 slits on the ventral side, deep purplish-red; **NSc** oblong, 0.8 - 1 mm, reddish; **Ca** 5.5 - 7.5 mm, erect; **Sty** 1.2 - 2 mm; **Fr** 6 - 8 mm, each follicle with 10 - 24 **Se**, these oblong, 1 - 1.3 mm, light brown.

R. hookeri S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 124, 1965). **T**: Nepal (*Wallich* 7233a [K, BM, CAL]). – **D**: Himalaya (Nepal to Bhutan). **Fig. XXIX.a**

Incl. *Sedum elongatum* Wallich ex Hooker fil. & Thomson (1858) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum bhutanense* Praeger (1921); **incl.** *Sedum bhutanicum* Praeger (1921) (*nom. illeg.*, Art. 52.1) ≡ *Rhodiola bhutanica* (Praeger) S. H. Fu (1965); **incl.** *Sedum hookeri* N. P. Balakrishnan (1970) (*nom. illeg.*, Art. 52.1); **incl.** *Sedum thomsonianum* H. Ohba (1973) (*nom. illeg.*, Art. 52.1).

[7] Differs from *R. bupleuroides* var. *bupleuroides*: **L** rectangular, margin sparsely and irregularly serrate; flowering stems greenish, erect, thick, to 8 mm Ø; **Fl** greenish.

R. humilis (Hooker fil. & Thomson) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 119, 1965). **T**: Sikkim (*Hooker* s.n. p.p. [K]). – **D**: Nepal, Sikkim, Tibet, China (Qinghai); alpine meadows, 3900 - 4500 m, flowers August to September. **I**: Ohba (1975: 294, as *Sedum*).

≡ *Sedum humile* Hooker fil. & Thomson (1858) ≡ *Chamaerhodiola humilis* (Hooker fil. & Thomson) Nakai (1934); **incl.** *Sedum levii* Hamet (1909); **incl.** *Sedum karpelesae* Hamet (1911) ≡ *Rhodiola karpelesae* (Hamet) S. H. Fu (1965); **incl.** *Sedum barnesianum* Praeger (1921).

[2] Hermaphrodite, usually 2 - 3 cm tall; rhizomes thick, cylindrical, 1.5 - 2 cm long, 0.5 - 1.5 cm Ø; radical **L** 10 - 20, erect, long-petiolate, petiole 8 - 18 × 0.4 - 1 mm, ± broadening towards the base, lamina linear-elliptic to narrowly rhombic-lanceolate or narrowly oblanceolate, 3 - 8 × 1.2 - 2.3 mm, glabrous, tip round or obtuse, margin entire; dead petioles of **L** of previous years degenerated into scaly appendages, long persistent, densely tufted, becoming rigid, blackish or chestnut-brown; flowering stems 3 - 5, annual, erect, glabrous, ± 0.9 mm Ø; **L** densely arranged, widely spreading, sessile, linear-ovate or linear-elliptic, 4.5 - 9.5 × 0.9 - 2.3 mm, tip round, base attenuate, entire, glabrous; **Fl** usually 8 - 11 mm Ø, usually solitary but rarely forming small 2- to 4-flowered corymbs; **Ped** 1.2 - 2 mm; **Cal** 3.2 - 5 mm, glabrous, tube 0.6 - 1.5 mm, lobes ovate, 2.6 - 3.5 mm, ascending; **Pet** oblong-ovate or ovate with a round tip, 5 - 6.5 mm, mostly white, ascending; **St** shorter than the **Pet**, nearly erect; **Fil** 3 - 5 mm, whitish; **Anth** reddish; **NSc** transversally oblong or depressed-ovate, 0.5 - 0.9 mm, probably ± orange; **Ca** 4 - 7.5 mm, erect, each with 8 - 10 ovules; **Sty** 0.5 - 1.7 mm; **Se** oblong, round at the tip, brownish, longitudinally striate.

R. imbricata Edgeworth (Trans. Linn. Soc. London 20(1): 47, 1846). **T:** India, Kumaon (Edgeworth s.n. [K]). – **D:** India (Kumaon), Nepal; flowers June to August. **I:** Ohba (1975: 305, as *Sedum*).

≡ *Sedum imbricatum* (Edgeworth) Walpers (1848); **incl.** *Sedum imbricatum* Hooker fil. & Thomson (1858) (*nom. illeg.*, Art. 53.1).

[7] Dioecious, to 30 cm tall; rhizomes subcylindrical to elongate ovoid, 2 - 2.5 cm Ø, sparsely branched; flowering stems glabrous, 10 - 20 cm, 4 - 6 mm Ø, elongating after flowering to 20 - 30 cm, 6 - 9 mm Ø; **L** densely arranged, sessile, oblanceolate to narrowly elliptic, 2 - 3 cm × 3 - 7 mm, glabrous, tip acute, base round or cuneate, margin nearly entire to remotely denticulate in the upper ½, nearly entire in the lower ½; **Inf** 1 - 1.5 × 2.5 - 3 cm Ø, compact, 20- to 40-flowered; **Ped** 3 - 5 mm, glabrous; **Cal** 4.5 - 6.5 mm, tube 1.2 - 2 mm, lobes linear to subulate, 3 - 4 mm; **Pet** angular-oblanceolate or oblong-obovate, 5 - 6.5 mm; **St** distinctly longer than the **Pet**; **Fil** 5.5 - 8 mm; **Anth** dark purplish-red; **NSc** widely oblong, 0.7 - 1.2 mm, dark red; **Ca** 3 - 5 mm, each with 8 - 10 ovules, tapering into indistinct **Sty**; **Fr** 8 - 12 mm; **Se** 1.5 mm, ellipsoid.

R. integrifolia Rafinesque (Atl. J. 1: 146, 1832). **T:** USA (Edwin James s.n. [NY]). – **D:** Siberia to Sakhalin and the Kuriles, North America.

≡ *Sedum integrifolium* (Rafinesque) Nelson (1909) ≡ *Rhodiola rosea* var. *integrifolia* (Rafinesque) Jepson (1925) ≡ *Sedum rosea* var. *integrifolium* (Rafinesque) A. Berger (1930) ≡ *Sedum rosea* ssp. *integrifolium* (Rafinesque) Hultén (1945) ≡ *Rhodiola rosea* ssp. *integrifolia* (Rafinesque) H. Hara (1952) ≡ *Tolmachevia integrifolia* (Rafinesque) A. Löve & D. Löve (1976); **incl.** *Sedum rhodiola* Torrey (1827) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum rhodioloide*s Rafinesque (1832).

R. integrifolia ssp. *integrifolia* – **D:** Arctic Siberia, Okhotsk, Sakhalin, Kuriles, Kamtchatka, Aleutian Islands, W North America (USA, Canada); flowers May to July. **I:** Ohba (1981a: 71).

Incl. *Sedum atropurpureum* Turczaninow (1840) ≡ *Rhodiola atropurpurea* (Turczaninow) Trautvetter & C. A. Meyer (1856) ≡ *Sedum rhodiola* var. *atropurpureum* (Turczaninow) Maximowicz (1883) ≡ *Sedum rosea* var. *atropurpureum* (Turczaninow) Praeger (1921) ≡ *Rhodiola rosea* ssp. *atropurpurea* (Turczaninow) H. Jacobsen (1973) ≡ *Tolmachevia atropurpurea* (Turczaninow) A. Löve & D. Löve (1976) ≡ *Sedum integrifolium* var. *atropurpureum* (Turczaninow) R. Stephenson (1994) (*nom. inval.*, Art. 33.2); **incl.** *Sedum atropurpureum* var. *caespitosum* Ledebour (1843) ≡ *Rhodiola caespitosa* (Ledebour) Nakai (1938); **incl.** *Sedum rhodiola* var. *humile* Regel & Tiling (1858) ≡ *Rhodiola caespitosa* fa. *humilis* (Regel & Tiling) Nakai (1938); **incl.** *Sedum rhodiola* var. *involutratum* Regel & Tiling (1858) ≡ *Rhodiola caespitosa* fa. *involutrata* (Regel

& Tiling) Nakai (1938); **incl.** *Sedum rhodiola* var. *lanceolatum* Regel & Tiling (1858) ≡ *Rhodiola caespitosa* fa. *lanceolata* (Regel & Tiling) Nakai (1938); **incl.** *Sedum rhodiola* var. *ovatum* Regel & Tiling (1858) ≡ *Rhodiola caespitosa* fa. *ovata* (Regel & Tiling) Nakai (1938); **incl.** *Sedum rhodiola* var. *tenuifolium* Regel & Tiling (1858); **incl.** *Sedum frigidum* Rydberg (1901) ≡ *Sedum rosea* var. *frigidum* (Rydberg) Hultén (1945); **incl.** *Sedum polygamum* Rydberg (1901) ≡ *Rhodiola polygama* (Rydberg) Britton & Rose (1903) ≡ *Sedum rosea* var. *polygamum* (Rydberg) Fröderström (1930) ≡ *Rhodiola rosea* ssp. *polygama* (Rydberg) H. Jacobsen (1973); **incl.** *Rhodiola alaskana* Rose (1903) ≡ *Sedum alaskanum* (Rose) J. K. Henry (1915) ≡ *Sedum rosea* var. *alaskanum* (Rose) A. Berger (1930) ≡ *Rhodiola rosea* var. *alaskana* (Rose) H. Jacobsen (1973); **incl.** *Sedum rosea* var. *aleuticum* Fröderström (1937); **incl.** *Rhodiola borealis* Borissova (1939) ≡ *Rhodiola rosea* ssp. *borealis* (Borissova) A. P. Khokhrjakov & Kurajev (1992).

[7] Dioecious, 5 - 30 cm tall; rhizomes stout, sparsely branched, 0.5 - 2 cm Ø; flowering stems 1 - 6, 1.5 - 6 mm Ø, glabrous, smooth to papillate; **L** approximate throughout, ascending to spreading, sessile, thickly herbaceous, oblanceolate to oblong-obovate, 0.5 - 2 (-3) × 0.2 - 1.3 cm, spinach-green, glabrous, smooth, tip obtuse to acute, base round to truncate, margin entire to coarsely and interruptedly serrate; **Inf** densely 8- to 70-flowered, 0.5 - 2 × 1 - 8 cm Ø; **Ped** 1.5 - 2.5 (-3) mm, smooth; **Fl** 3 - 6 mm Ø; **Cal** green but often reddish, 3 - 4.1 mm, glabrous, lobes linear to linear-subulate, 1 - 2.8 mm, erect; **Pet** purplish-red to crimson, narrowly spatulate (male) or linear-subulate (female), 2.4 - 4 (-4.3) mm, spreading (male) or suberect (female); **St** slightly longer than the **Pet**; **Fil** reddish to red-purple, 2.8 - 4.6 mm; **Anth** red-purple; **NSc** oblong, 0.7 - 1.4 mm, yellow to reddish; **Ca** 5 - 7 (-9) mm [or 1.7 - 4 mm (male)], abruptly narrowed above, with 6 - 10 ovules each; **Sty** 0.7 - 1 mm; **Fr** 3.7 - 10 mm, usually with straight **Sty**; **Se** 1.4 - 2.3 mm, tip round, brown, with low longitudinal ridges.

R. integrifolia ssp. *leedyi* (Rosendahl & Moore) Moran (CSJA 72(3): 138, 2000). **T:** USA, Minnesota (*Leedy* s.n. [MIN]). – **D:** USA (New York, Minnesota). **I:** Clausen (1975: 502-506, as *Sedum*).

≡ *Sedum rosea* var. *leedyi* Rosendahl & Moore (1947) ≡ *Sedum integrifolium* ssp. *leedyi* (Rosendahl & Moore) R. T. Clausen (1975) ≡ *Tolmachevia integrifolia* ssp. *leedyi* (Rosendahl & Moore) A. Löve & D. Löve (1985).

[7] Differs from ssp. *integrifolia*: **L** narrowly oblong, glaucous; **Pet** reddish; **Se** 2.4 mm.

R. integrifolia ssp. *neomexicana* (Britton) H. Ohba (J. Jap. Bot. 74(1): 61, 1999). **T:** USA, New Mexico (*Wooton* s.n. [NY]). – **D:** USA (New Mexico).

≡ *Rhodiola neomexicana* Britton (1903) ≡ *Sedum*

rosea var. *neomexicanum* (Britton) A. Berger (1930) $\equiv$ *Rhodiola rosea* ssp. *neomexicana* (Britton) H. Jacobsen (1973) $\equiv$ *Sedum integrifolium* ssp. *neomexicanum* (Britton) R. T. Clausen (1975) $\equiv$ *Tolmachevia integrifolia* ssp. *neomexicana* (Britton) A. Löve & D. Löve (1985).

[7] Differs from ssp. *integrifolia*: **L** lanceolate, 3.6 $\times$ as long as broad; **Pet** yellow, tip tinged red.

R. integrifolia ssp. *procera* (R. T. Clausen) H. Ohba (J. Jap. Bot. 74(1): 61, 1999). **T**: USA, Colorado (Clausen 62-69 [CU]). – **D**: USA (S Rocky Mountains). **I**: Clausen (1975: 507-508, as *Sedum*).

$\equiv$ *Sedum integrifolium* ssp. *procera* R. T. Clausen (1975) $\equiv$ *Tolmachevia integrifolia* ssp. *procera* (R. T. Clausen) A. Löve & D. Löve (1985).

[7] Differs from ssp. *integrifolia*: Flowering stems 10 cm tall or more; **L** oblong-lanceolate, elongate, mostly > 2.5 $\times$ as long as broad; **Pet** reddish; **Se** < 2 mm.

R. ishidae (Miyabe & Kudo) H. Hara (J. Jap. Bot. 13: 930, 1937). **T**: Japan, Hokkaido (*Yanagisawa* & *Hamana* s.n. [SAP]). – **D**: Japan (Hokkaido, Honshu), Russia (Far East: Kuriles). **I**: Ohba (1981a: 109).

$\equiv$ *Sedum ishidae* Miyabe & Kudo (1921) $\equiv$ *Rhodiola himalensis* var. *ishidae* (Miyabe & Kudo) H. Jacobsen (1973); **incl.** *Rhodiola stephanii* var. *hondoensis* Nakai (1938); **incl.** *Rhodiola stephanii* var. *longifolia* Nakai (1938).

[7] Dioecious, to 7 - 25 cm tall; rhizomes cylindrical, to 1.5 cm $\varnothing$, often branched; flowering stems 1 - 5, persistent for 1 year after death, glabrous, mammillate; **L** approximate, ascending to spreading, thickly herbaceous, linear-oblong to oblong-ovate, 1.5 - 5 $\times$ 0.4 - 1 cm, glabrous, nearly smooth, tip obtuse to acute, base attenuate, margin coarsely serrate; **Inf** 15- to 50-flowered, 1 - 2 $\times$ 2 - 4 cm $\varnothing$, flat-topped; **Fl** 4-merous; **Ped** 1.5 - 3 mm, smooth; **Cal** 2.5 - 3.4 mm (male) or 3.8 - 4.5 mm (female), tube $\pm$ 1 mm (male) or $\pm$ 1.5 mm (female), lobes oblong (male) or oblong to oblong-subulate (female), 1.5 - 2.5 mm (male) or 2.3 - 3 mm (female); **Pet** greenish-yellow, linear to oblong, 3 - 4 mm (male) or 2.2 - 2.7 mm (female), spreading to ascending (male) or erect (female); **St** longer than the **Pet**, 3.6 - 4.5 mm; **Anth** orange or deep yellow; **NSc** oblong to nearly square, 0.6 - 0.9 mm, orange or deep yellow; **Ca** 8 - 12 mm, each with 6 - 10 ovules [2.5 - 3.5 mm (male), each with 0 - 2 ovules], tapering, ventrally not gibbose; **Sty** 1 - 2 mm; **Fr** with erect **Sty**, 10 - 14 mm; **Se** lunate, 2.5 - 2.7 mm, winged, brown, rather smooth.

R. junggarica C. Y. Yang & N. R. Cui ex C. Y. Yang (Acta Phytotax. Sin. 20(3): 321-322, ill., 1982). **T**: China, Xinjiang (Cui 730595 [XJA]). – **D**: China (W Xinjiang); subalpine and alpine meadows, 2500 - 2700 m.

[7] Differs (on the base of the protologue) from *R. heterodonta*: **L** greenish-yellow; **Fl** 4-merous, **Sep** linear; **Pet** elliptic, 2 mm, reddish.

R. kaschgarica Borissova (in Komarov & al. (eds.), Fl. URSS 9: 476, 1939). **T**: China, Xinjiang (*Divnogorskaya* s.n. [LE]). – **D**: Kazakhstan, China (SW Xinjiang); rocks, 2600 - 3200 m, flowers June to July.

[9] Dioecious, to 8 cm tall; rhizomes massive, with the remains of old flowering stems; flowering stems divergent, 0.5 - 1 mm $\varnothing$, glabrous; **L** spreading, sessile, oblong to linear-lanceolate, 3 - 10 $\times$ 1 - 2 mm, glabrous, tip obtuse, base attenuate, margin entire; **Inf** 15- to 20-flowered, compact or rather lax, 0.5 - 1 cm $\varnothing$; **Fl** shortly pedicellate; **Sep** linear, 2 - 3 mm; **Pet** oblong-lanceolate, 3 - 4 mm; **St** nearly as long as the **Pet**; **Fil** yellow; **Anth** yellow; **NSc** $\pm$ square to oblong, $\pm$ 1 mm; **Fr** 3 - 4 mm; **Se** lanceolate, $\pm$ 1.5 mm, brown.

R. kirilowii (Regel) Regel & Maximowicz (Mém. Acad. Imp. Sci. St. Pétersbourg Divers Savans 9: 472, 1859). **T**: China (*Kirilow* s.n. [LE]). – **D**: Kazakhstan, Tibet, China (Gansu, Hebei, Qinghai, Shaanxi, Shanxi, Sichuan, Xinjiang, Yunnan), Myanmar; forest margins, grassy slopes, often in partial shade, 2000 - 5600 m. **I**: Ohba (1981a: 104). **Fig. XXIX.b, XXIX.d**

$\equiv$ *Sedum kirilowii* Regel (1858) $\equiv$ *Sedum rosea* f. *kirilowii* (Regel) Thellung & F. Zimmermann (1916); **incl.** *Sedum kirilowii* var. *linifolium* Regel & Schmalhausen (1878); **incl.** *Sedum macrolepis* Franchet (1885) $\equiv$ *Rhodiola macrolepis* (Franchet) S. H. Fu (1965); **incl.** *Sedum longicaule* Praeger (1917) $\equiv$ *Rhodiola longicaulis* (Praeger) S. H. Fu (1965); **incl.** *Sedum robustum* Praeger (1917) $\equiv$ *Rhodiola robusta* (Praeger) S. H. Fu (1965); **incl.** *Sedum kirilowii* var. *rubrum* Praeger (1921) $\equiv$ *Sedum kirilowii* cv. *Rubrum* (s.a.) $\equiv$ *Rhodiola kirilowii* var. *rubra* (Praeger) H. Jacobsen (1973); **incl.** *Sedum kirilowii* var. *altum* Fröderström (1924); **incl.** *Rhodiola linearifolia* Borissova (1939); **incl.** *Rhodiola kirilowii* var. *latifolia* S. H. Fu (1965).

[7] Dioecious, to 25 - 80 cm tall; rhizomes carrot-shaped, 3 - 4 cm $\varnothing$, often branched; flowering stems 1 - 3, 4 - 7 mm $\varnothing$, glabrous, smooth; **L** densely arranged throughout, ascending to spreading, sessile, thickly herbaceous, linear to linear-lanceolate, 4 - 5 cm $\times$ 3 - 5 mm, glabrous, tip acute to acuminate, base round to shallowly cordate, margin entire to distantly low serrate; **Inf** compact, umbel-like, with > 90 (female) or > 300 (male) **Fl**, 2 - 2.5 $\times$ 3 - 4.5 cm $\varnothing$; **Ped** 3 - 4.5 mm; **Fl** 5 - 7 mm $\varnothing$; **Cal** 3 - 4 (-5) mm (male) or 2.5 - 4 mm (female), glabrous, tube 1 - 1.2 mm, lobes subulate to triangular, 1.6 - 2 mm; **Pet** pale yellow-green, ovate with claw-like base (male) or narrowly oblong (female), 4 - 5 (-7.5) mm (male) or 2.5 - 3 mm (female), spreading at anthesis; **St** apparently longer than the

Pet; **Fil** 4 - 6 (-8.5) mm; **Anth** yellow; **NSc** oblong, 0.7 - 1 mm; **Ca** 6 - 8 mm, each with 6 - 8 ovules [3 - 4 mm (male), with 1 - 2 ovules], ventrally straight; **Sty** $\pm$ 0.5 mm.

R. litwinowii Borissova (in Komarov & al. (eds.), Fl. URSS 9: 43, 478, ill., 1939). **T**: Kirgistan, Andizhan Distr. (*Litvinov* s.n. [LE]). – **D**: Uzbekistan, Mongolia, China (Xinjiang); below 3200 m, flowers June to July.

[9] Dioecious, to 17 cm tall; rhizomes massive, $\pm$ 1 - 2 cm $\varnothing$ with few remains of old flowering stems; flowering stems numerous, 2 - 4 mm $\varnothing$; **L** densely arranged throughout, elliptic, 10 - 15 $\times$ 3 - 5 mm, pale green, tip obtuse, base cuneate, margin conspicuously dentate; **Inf** dense, many-flowered, compact, 2 - 2.5 cm $\varnothing$; **Ped** 3 - 5 mm; **Fl** yellow, 4- or 5-merous, $\pm$ 4 mm long; **St** longer than the **Pet**; **Fil** yellow; **Anth** yellow; **NSc** square; **Fr** $\pm$ 8 mm; **Se** oblong-lanceolate, 1.5 - 2 mm, brown.

R. lobulata (Singh & Bhattacharyya) H. Ohba (J. Jap. Bot. 61(7): 205, 1986). **T**: India, Himachal Pradesh (*Nair* 32763 [CAL, BSD]). – **D**: W Himalaya (India, Nepal).

$\equiv$ *Rhodiola imbricata* var. *lobulata* Singh & Bhattacharyya (1985).

[7] Dioecious, to 25 cm tall; flowering stems $\pm$ 5 mm $\varnothing$, glabrous; **L** narrowly elliptic to angular-oblongate, 2 - 4 $\times$ 0.8 - 1.5 cm, glabrous, tip acute, margin remotely crenulate; **Fl** (female) 5-merous; **Cal** 5 - 6 mm, tube 1.5 - 2 mm, lobes subulate, 3.8 - 4 mm; **Pet** narrowly oblong to linear, 4 - 5 mm, white; **NSc** broadly oblong, 0.7 - 1.2 mm; **Ca** 4.5 - 7 mm, each with 20 - 22 ovules; **Sty** indistinct.

This species is similar to *R. litvinovii* but differs by the larger leaves and indistinct styles.

R. ludlowii H. Ohba (J. Jap. Bot. 52(9): 266-267, 1977). **T**: Bhutan (*Ludlow & al.* 17158 [BM]). – **D**: Bhutan.

$\equiv$ *Sedum ludlowii* (H. Ohba) J. P. Kozhevnikov (1989).

[7] Dioecious, to 12 cm tall; rhizomes cylindrical, 2 - 5 mm $\varnothing$, branched; flowering stems $\pm$ 1 mm $\varnothing$, tuberculate; **L** sessile, spatulate to oblanceolate, 4 - 14 $\times$ 2 - 4 mm, glabrous, tip round, base long attenuate; **Fl** (female) solitary, sessile, erect, 7 - 8 mm long; **Sep** lobes lanceolate to narrowly ovate, 4.5 - 5 mm; **Pet** broadly elliptic to oblong, 6 - 7 mm, probably pale green or white; **NSc** linear, $\pm$ 1.5 mm; **Ca** 5 - 6 mm, each with $\pm$ 8 ovules; **Sty** $\pm$ 1 mm.

R. macrocarpa (Praeger) S. H. Fu (Acta Phytotax. Sin. 10 (Addit. 1): 125, 1965). **T** [lecto]: Burma (*Kingdon-Ward* 3412 [E]). – **D**: SE Tibet, Myanmar, China (Gansu, Qinghai, Shaanxi, Sichuan, NW Yunnan); rocks on slopes, 2900 - 4300 m, flowers

July to September. **I**: Ohba (1981a: 87). **Fig. XXIX.c**

$\equiv$ *Sedum macrocarpum* Praeger (1921); **incl.** *Sedum eurycarpum* Fröderström (1924) $\equiv$ *Chamaerhodiola eurycarpa* (Fröderström) Nakai (1934) $\equiv$ *Rhodiola eurycarpa* (Fröderström) S. H. Fu (1965); **incl.** *Sedum progressum* Diels (1930).

[7] Dioecious, to 50 cm tall; rhizomes subcylindrical, usually 8 - 12 mm $\varnothing$, simple to sparsely branched, often stoloniferous; flowering stems 2 (-3), 2 - 4 mm $\varnothing$, papillate; **L** $\pm$ remote throughout, sessile, obtrullate to linear-oblongate, 2 - 4.5 $\times$ 0.4 - 1.1 cm, glabrous, tip acute, base attenuate, margin sparsely denticulate to roughly serrate, papillate; **Inf** compact, 20- to 40-flowered, 3 - 7 cm $\varnothing$; **Ped** 2 - 4 mm, densely papillate; **Cal** glabrous, tube $\pm$ 0.5 mm, lobes linear-subulate, 4 - 5 mm (male) or 4.5 - 7 mm (female); **Pet** pale yellowish-green, elliptic (male) or subulate with round tip (female), 4.8 - 5.5 mm (male) or 3.2 - 3.7 mm (female); **St** longer than the **Pet**; **Fil** 7 - 9 mm; **Anth** purplish-red; **NSc** oblong to square, 0.8 - 1.1 mm; **Ca** 9 - 11 mm, each with 14 - 18 ovules [4 - 5 mm (male)], ventrally straight; **Sty** $\pm$ 2 mm; **Fr** 10 - 14 mm; **Se** oblong, 1.3 - 2.5 mm, tailed, light brown, with fine cross-band markings.

R. marginata Grierson (Notes Roy. Bot. Gard. Edinburgh 42(1): 109-111, ill., 1984). **T**: Bhutan (*Ludlow & al.* 19133 [BM]). – **D**: Bhutan.

[7] Dioecious, 0.5 - 2.5 cm tall; rhizomes 5 - 15 mm $\varnothing$ at the tip; flowering stems densely papillate; **L** 5 - 8, aggregated towards the stem tip, obovate to suborbiculate or fan-shaped, 3 - 7 mm long and wide, tip round or acutish, base abruptly attenuate, lower face papillate, margin thickened pale green ($\pm$ 0.5 mm broad), petioles $\pm$ 7 mm; **Inf** 3- to 20-flowered; **Ped** $<$ 1 mm; **Fl** (male) 4-merous; **Sep** elliptic, 2.5 mm, marginate; **Pet** ovate, slightly shorter than the **Sep**, reddish; **St** $\pm$ 1 mm; **NSc** subquadrate, $\pm$ 0.25 mm.

This might be the male plant of *R. atsaensis*.

R. nepalica (H. Ohba) H. Ohba (J. Jap. Bot. 51(12): 386, 1976). **T**: Nepal (*Stainton & al.* 2222 [BM, TI]). – **D**: Nepal; flowers August and September. **I**: Ohba (1974: 324); Ohba (1975: 314); both as *Sedum*.

$\equiv$ *Sedum nepalicum* H. Ohba (1974).

[4] Hermaphrodite, 10 - 30 cm tall; rhizomes subcylindrical, 6 - 10 mm $\varnothing$, upper part branched; flowering stems 3 - 5, papillate; **L** spreading, densely arranged, sessile, narrowly elliptic or lanceolate, 10 - 45 $\times$ 6 - 15 mm, glabrous, tip round, base long cuneate to attenuate, margin 5- or 7-lobulate or remotely crenate-serrate; **Inf** 6- to 15-flowered; **Ped** 1 - 6.5 mm, papillate; **Cal** 5 - 7 mm, glabrous, lobes linear to linear-subulate, 4 - 5.5 mm; **Pet** white, narrowly elliptic or narrowly lanceolate, entire, 8 - 15 mm; **St** as long as the **Pet**; **Fil** 7 - 13 mm;

Anth dark purplish-red; **NSc** oblong, 0.9 - 1.2 mm, yellow; **Ca** 12 - 18 mm, tapering, each with 14 - 24 ovules.

R. nobilis (Franchet) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 120, 1965). **T**: China, Yunnan (*Delavay* 3171 [P]). – **D**: NE Myanmar, SW China (NW Yunnan); thickets and grassy slopes, 3700 - 4500 m. **I**: Ohba (1982a: 162).

≡ *Sedum nobile* Franchet (1896) ≡ *Chamaerhodiola nobilis* (Franchet) Nakai (1934); **incl.** *Sedum horridum* Praeger (1921) ≡ *Chamaerhodiola horrida* (Praeger) Nakai (1934).

[9] Dioecious, 4 - 7 cm tall; rhizomes cylindrical, 1.2 - 2.5 cm Ø, unbranched; flowering stems densely fastigiate, 1 - 1.2 mm Ø, purplish-brown, papillate, marcescent; flowering stems of the same age verticillate in umbel-like fashion, basally bent, with conspicuous **L** scars; **L** densely arranged throughout the stems, ascending to spreading, narrowly oblong to linear-oblongate, 6 - 10 × 1.6 - 2.5 mm, glabrous, tip acute to obtuse, base shortly attenuate, margin entire; **Inf** terminal, 1- to 4-flowered, 5 - 7 × 7 - 15 mm Ø; **Fl** 4-merous, 4 - 5 mm long; **Ped** < 1 mm, smooth; **Cal** (male) 2.5 - 4.5 mm, lobes narrowly triangular to linear-subulate, 2 - 2.5 mm; **Pet** (male) oblong to broadly oblong, 4 - 6 mm, white or pinkish, ascending to suberect; **St** longer than the **Pet**; **NSc** very broadly oblong to square, 0.7 - 0.9 mm; **Ca** 7 - 9 mm, each with ± 6 ovules [3 - 5 mm (male)]; **Fr** ± 12 mm; **Se** linear to lunate, 2.8 - 3 mm, terminally winged, brown, longitudinally lowly striate.

R. pachyclados (Aitchison & Hemsley) H. Ohba (J. Jap. Bot. 51(12): 385-386, 1976). **T**: Afghanistan (*Aitchison* 469 [K, DD, FI, P]). – **D**: W Himalaya (Afghanistan, Pakistan); flowers in December. **I**: Ohba (1980: 371).

≡ *Sedum pachyclados* Aitchison & Hemsley (1880) ≡ *Rhodiola primuloides* var. *pachyclados* (Aitchison & Hemsley) H. Jacobsen (1973).

[2] Hermaphrodite, 2 - 3 cm tall; rhizomes cylindrical, 2 - 4 mm Ø; **Ros** with 12 - 18 foliage **L**, 1.5 - 2.5 cm Ø, with few withered dead radical **L** below; radical **L** annual but ± persistent, shortly petiolate, lamina broadly oblong-obovate to obovate, 4 - 10 × 2.7 - 6 mm, glabrous, tip round to obtuse, base attenuate, margin shallowly 3- or 5-lobulate or sinuate in the upper part or rarely nearly entire; petiole broad, flat, broadening towards the base, 1 - 1.2 × 1.7 - 2.5 mm; flowering stems usually 1 from each **Ros**, glabrous; **L** sessile, narrowly obovate to spatulate-obovate, 4 - 5.5 × 1.6 - 2.2 mm, glabrous, tip round, base attenuate, margin entire; **Inf** semiglobose, 0.8 - 2 cm Ø; **Fl** 3.5 - 4.5 mm Ø; **Ped** 0.5 - 1 mm, glabrous; **Cal** 4.5 - 5 mm, glabrous, lobes oblong-ovate, 3.6 - 4 mm; **Pet** oblong-spatulate to oblanceolate, 6 - 7 mm, reddish (?); **St** shorter than the **Pet**; **Anth** reddish; **NSc** oblong to

broadly oblong, 0.7 - 0.9 mm, reddish; **Ca** 6.5 - 7.5 mm, each with 8 - 12 ovules; **Sty** 1.5 - 2 mm.

R. pachyclados shows a superficial similarity with species of *Rosularia*, but is clearly distinguishable from the latter by having radical foliage leaves with a broadened base. *R. pachyclados* differs from *R. primuloides* in having radical foliage leaves with a shallowly 3- or 5-lobulate tip, narrowly elliptic to oblong-spatulate to oblanceolate petals with entire margins, and corymbose inflorescences with 3 - 8 flowers.

R. pamiroalaica Borissova (in Komarov & al. (eds.), Fl. URSS 9: 40, 477, 1939). **T** [syn]: Tadzhikistan (*Korshinsky* 2535+2537 [LE]). – **D**: Tadzhikistan, China (W Xinjiang); valley slopes, rock crevices, 2400 - 2800 m, flowers June to July.

≡ *Sedum pamiroalaicum* (Borissova) Jansson (1970).

[9] Dioecious, to 25 cm tall; rhizomes thick, 1.5 - 3 cm Ø; flowering stems numerous, 2 mm Ø, glabrous; **L** remote, sessile, linear to lanceolate, 7 - 15 × 1.5 - 2 mm, glabrous, tip acuminate, widening towards the base, margin entire; **Inf** many-flowered, dense, 0.5 - 1 cm long, shortly pedunculate; **Sep** lanceolate to linear, ± 2 mm; **Pet** linear to lanceolate, ± 4 mm, pale yellow; **St** shorter than the **Pet**; **Fil** pale yellow; **Anth** yellow; **NSc** square; **Fr** ± 6 mm; **Se** 2 mm, brown.

R. prainii (Hamet) H. Ohba (J. Jap. Bot. 51(12): 386, 1976). **T**: Sikkim (*Prain* s.n. [CAL, Herb. Hamet]). – **D**: NE India (Assam), Nepal, Sikkim, Tibet; rocks in broad-leaf forests etc., 2200 - 4300 m, flowers August to September. **I**: Ohba (1975: 300, as *Sedum*).

≡ *Sedum prainii* Hamet (1909); **incl.** *Sedum apiculatum* Craib ex Hamet (1929) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum stewartii* Craib ex Hamet (1929) (*nom. inval.*, Art. 34.1c).

[8] Hermaphrodite, to 3 cm tall; rhizomes thick, 1.5 - 2 cm Ø; flowering stem solitary, papillate, 2 mm Ø; **L** usually 4, nearly verticillate in the lower ½ of the stem, oblong-elliptic to broadly elliptic or ovate, 2 - 6 × 2.5 - 4 cm, papillate, tip round, base attenuate, margin nearly entire; petiole 1 - 3 cm; **Inf** semiglobose, 1 - 2.5 cm Ø, 13- to 18-flowered; **Fl** 4 - 5 mm Ø; **Cal** 4 - 6 mm, lobes narrowly triangular-ovate, 2.5 - 3.7 mm; **Pet** ovate, 4 - 6.3 mm, pale pink or greenish-white; **St** shorter than the **Pet**; **Fil** 2 - 3.5 mm, pale pink; **Anth** purplish-red; **NSc** square, 0.5 - 0.7 mm; **Ca** 3.5 - 5.2 mm, each with 34 - 40 ovules, reddish; **Sty** slender, 0.6 mm.

R. primuloides (Franchet) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 118, 1965). **T**: China, Yunnan (*Delavay* 121 [P]). – **D**: Tibet, SW China.

≡ *Sedum primuloides* Franchet (1896).

R. primuloides ssp. *kongboensis* H. Ohba (J. Jap.

Bot. 53(11): 330, 1978). **T:** Tibet, Kongbo Prov. (Ludlow & al. 14299 [BM, KATH, TI]). – **D:** SE Tibet; rocks in valleys, $\pm$ 2500 m. **I:** Ohba (1980: 362).

[2] Differs from ssp. *primuloides*: **Cal** lobes broadly oblong, 3.2 - 3.6 mm; **Pet** 7.5 - 8.5 $\times$ 4 - 4.5 mm, margin entire, basally shortly clawed.

This subspecies is well characterized by the larger entire petals and broadly oblong calyx-lobes. It is also geographically segregated.

R. primuloides ssp. *primuloides* – **D:** China (SE Qinghai, SW Sichuan, W Yunnan); rocks on slopes, 2500 - 4400 m, flowers August to October. **I:** Ohba (1980: 362). **Fig. XXX.a**

Incl. *Sedum pleurogynanthum* Handel-Mazetti (1922) $\equiv$ *Sedum primuloides* var. *pleurogynanthum* (Handel-Mazetti) Fröderström (1930) $\equiv$ *Rhodiola pleurogynantha* (Handel-Mazetti) S. H. Fu (1965).

[2] Hermaphrodite, 3 - 5 cm tall; rhizomes $\pm$ cylindrical, 5 - 8 mm $\varnothing$, often branched; **Ros** with 30 - 50 **L**, 2 - 3.5 cm $\varnothing$, with withered radical **L** below; radical foliage **L** petiolate, persistent after drying, broadly elliptic to orbicular to rhombic-ovate, 2 - 4 $\times$ 1.5 - 5 mm, glabrous, tip round, base attenuate, margin entire; petiole broadening towards base, 4 - 7 (-8) $\times$ 0.3 - 0.9 mm at the narrowest part, 2.5 - 3.5 mm wide at the base; dead **L** marcescent, degenerated into scaly appendages, brownish; scaly radical **L** triangular-ovate, 5 - 6 mm, brownish; flowering stem usually 1 from each **Ros**, glabrous; **L** sessile, oblong to narrowly obovate, 2.5 - 5 $\times$ 0.9 - 1.1 mm, glabrous, tip round to obtuse, base attenuate and then broadening, margin entire; **Inf** terminal, with 1 (-3) **Fl**; **Fl** urceolate, erect, 6 - 8 mm $\varnothing$; **Cal** 4 - 6.5 mm, lobes lanceolate to triangular-ovate, 3.2 - 4.5 mm; **Pet** broadly ovate to obovate or broadly elliptic, 5 - 6.5 mm, white, irregularly fimbriate to erose along the margins, base shortly attenuate to clawed; **St** shorter than the **Pet**, 4 - 5 mm; **Anth** yellow; **NSc** square to oblong-obovate, 0.6 - 0.7 mm, orange-yellow; **Ca** 4.7 - 6 mm, each with 8 - 12 ovules; **Sty** 1 - 1.5 mm.

R. purpureoviridis (Praeger) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 125, 1965). **T:** China, Yunnan (Forrest s.n. [E]). – **D:** Tibet, China.

$\equiv$ *Sedum purpureoviride* Praeger (1917) $\equiv$ *Sedum bupleuroides* var. *purpureoviride* (Praeger) Fröderström (1930).

R. purpureoviridis ssp. *phariensis* (H. Ohba) H. Ohba (J. Jap. Bot. 61(7): 206, 1986). **T:** Tibet (Dungbo s.n. [CAL]). – **D:** S Tibet. **I:** Ohba & Rajbhandari (1986: 207).

$\equiv$ *Sedum phariense* H. Ohba (1973) $\equiv$ *Rhodiola phariensis* (H. Ohba) S. H. Fu (1980).

[7] Differs from ssp. *purpureoviridis*: Flowering stems 10 - 25 cm tall, glabrous, nearly smooth or inconspicuously papillate; **L** sessile, elliptic to nar-

rowly ovate, 1 - 2.5 cm $\times$ 4 - 9 mm, tip round or obtuse, base round or cordate, margin serrate; **Cal** lobes ascending or suberect; **Pet** green with deep purplish-red stripes; **Fil** purplish-red; **Anth** greenish-red; **NSc** blackish-purple; **Ca** green, later tinged red.

Differs primarily by the smooth or inconspicuously papillate flowering stems and the somewhat narrower leaves.

R. purpureoviridis ssp. *purpureoviridis* – **D:** China (W Sichuan, NW Yunnan); forests or forest margins, grassland near streams, stony places, grassy slopes, 2500 - 4100 m. **I:** Praeger (1921a: 47, as *Sedum*).

[7] Gynodioecious, 15 - 40 cm tall; rhizomes cylindrical, 1.5 - 2.5 cm $\varnothing$; flowering stems 1 - 2, 4 - 6 mm $\varnothing$, often purplish, densely papillate; **L** approximate throughout, sessile, spreading to ascending, narrowly oblong to lanceolate, 2.5 - 4 $\times$ 0.3 - 1.2 cm, papillate, tip acute to obtuse, base truncate to slightly auriculate, margin sparsely dentate or serrate; **Inf** compactly 80- to 200-flowered, semiglobose, 4 - 5 $\times$ 5 - 8 cm $\varnothing$; **Ped** 3 - 6 mm, densely papillate; **Fl** 4 - 5 mm (hermaphrodite) or 2 - 3 mm (female) $\varnothing$; **Cal** 2.8 - 3.5 mm, papillate outside, lobes subulate to subulate-lanceolate (hermaphrodite) or linear to narrowly oblong (female), 2.2 - 2.6 $\times$ 0.5 - 0.9 mm, ascending to spreading or reflexed (hermaphrodite) or suberect (female); **Pet** pale yellow-green, linear-spatulate to narrowly oblong-spatulate (hermaphrodite) or subulate to narrowly triangular (female), 3.8 - 4.5 mm (hermaphrodite) or 1 - 1.4 mm (female), spreading (hermaphrodite) or suberect (female); **St** longer than the **Pet**; **Fil** 4 - 4.5 mm; **Anth** purplish-red; **NSc** oblong, 1 - 1.5 mm, blackish-purple; **Ca** 3 - 3.5 mm (hermaphrodite) or 4 - 4.5 mm (female); **Sty** $\pm$ 0.5 mm, erect (hermaphrodite) or reflexed (female); ovules 4 - 6 (hermaphrodite) or 6 - 10 (female) per **Ca**; **Se** linear, 1.6 - 1.8 mm, brown, longitudinally ridged.

R. quadrifida (Pallas) Fischer & C. A. Meyer (Enum. Pl. Nov. Schrenk 1: 69, 1841). **T:** Russia, Siberia (*Pallas* s.n. [BM]). – **D:** E Russia, Kazakhstan, Mongolia, China (Xinjiang); alpine and arctic regions, stony slopes and rocks, 2300 - 3700 m. **I:** Ohba (1982a: 155).

$\equiv$ *Sedum quadrifidum* Pallas (1776) $\equiv$ *Chamaerhodiola quadrifida* (Pallas) Nakai (1934) $\equiv$ *Kirpicznikovia quadrifida* (Pallas) A. Löve & D. Löve (1976); **incl.** *Rhodiola quadrifida* var. *major* Fischer & C. A. Meyer (1841); **incl.** *Rhodiola quadrifida* var. *minor* Fischer & C. A. Meyer (1841).

[9] Dioecious, 6 - 9 cm tall; rhizomes obconical; flowering stems fastigiate, 1 - 1.4 mm $\varnothing$, glabrous, smooth, marcescent; **L** approximate, sessile, flat, linear-elliptic to very narrowly oblong or linear-lanceolate, spreading, 5 - 12 $\times$ 0.8 - 1.5 mm wide, glabrous, tip round to obtuse, margin entire; **Inf** ter-

minal, 6- to 12-flowered; **Ped** usually 1.2 - 2 mm, smooth; **Fl** 4-merous, 3 - 4 mm Ø; **Cal** 2.5 - 3.5 mm, glabrous, lobes linear-subulate to subulate, 1.8 - 2.5 mm; **Pet** oblong-ovate, white, 2.7 - 3 mm, ascending (male) or suberect (female); **St** as long as the **Pet**; **NSc** linear to narrowly oblong, 1 - 1.2 mm; **Ca** 4 - 6 mm [2 - 3.5 mm (male)], each with 4 - 6 ovules; **Fr** 6 - 7 mm, red-brown; **Se** elliptic, 1.8 - 2 mm, terminally winged, bright brown, longitudinally lowly striate.

R. recticaulis Borissova (in Komarov & al. (eds.), Fl. URSS 9: 478, 1939). **T:** Tadzhikistan, Pamir (Korshinsky 2540 [LE]). – **D:** Iran, Kazakhstan, Tadzhikistan (Pamir), NW China (Xinjiang: Tian Shan); rock crevices, 3800 - 4600 m, flowers June to August.

≡ *Sedum recticaule* (Borissova) Wendelbo (1952).

[9] Dioecious, to 15 cm tall; rhizomes conical, 3 - 4 cm Ø, branched, crowned with the remnants of spent flowering stems; flowering stems numerous, 1.5 - 2 mm Ø; **L** ovate to oblong-ovate, 8 - 10 × 0.2 - 0.3 mm, glabrous, tip acuminate, margin coarsely dentate; **Inf** dense, compact, many-flowered, ± 1.5 - 2 cm Ø; **Fl** 4-merous, shortly pedicellate; **Cal** lobes ½ as long as the **Pet**, ovate, reddish; **Pet** oblong-elliptic, ± 4 mm, yellow; **St** longer than the **Pet**; **Fil** yellow; **NSc** subsquare; **Se** ± 2 mm, oblong, brown.

R. rhodantha (A. Gray) H. Jacobsen (Nation. Cact. Succ. J. 28(1): 5, 1973). **T:** USA (Parry s.n. [GH]). – **D:** USA (S and C Rocky Mountains, Colorado Plateau, Mogollon Mts.). **I:** Praeger (1921a: 68, as *Sedum*).

≡ *Sedum rhodanthum* A. Gray (1862) ≡ *Clementia rhodantha* (A. Gray) Rose (1903).

[5] Hermaphrodite, to 40 cm tall; rhizomes stout, branched, 1 - 7 cm Ø; flowering stems erect; **L** elliptic-oblong to oblong, 14 - 28 × 4 - 7 mm, glabrous, tip acute to obtuse, margin entire or sparsely toothed; **Inf** elongate or sometimes congested; **Fl** 4- or 5-merous, 7 - 10 mm Ø, nearly sessile; **Cal** deeply divided, lobes divergent, lanceolate, 7 - 8 mm; **Pet** erect, oblanceolate-oblong, pink, rarely white, 9 - 12 mm; **St** distinctly shorter than the **Pet**; **Fil** 5 - 7 mm, pink; **Anth** crimson; **NSc** reniform to reniform-ovoid, pale yellow, 0.6 - 0.8 mm; **Ca** pink or white, 7 - 11 mm, with slender **Sty**; **Se** fusiform-oblong, shortly tailed, obscurely longitudinally ribbed with transversal ladder-like riblets, pale brown, ± 1.9 mm.

R. rosea Linné (Spec. Pl. [ed. 1], 1035, 1753). **T:** LINN 1186.1. – **Lit:** Jalas & al. (1999: 124-125). **D:** N, C and S Europe (W-wards to the Pyrenees, S-wards to S Bulgaria), Russia (Ural, Siberia), Mongolia, N China, Korea, Japan, Sakhalin, Kuriles, N America (N USA and Canada), Greenland; flowers May to July. **I:** Ohba (1981a: 71). **Fig. XXX.b**

≡ *Sedum rosea* (Linné) Scopoli (1771); **incl. Rhodiola minor** Miller (1768); **incl. Rhodiola odorata** Lamarck (1778); **incl. Rhodiola odora** Salisbury (1796); **incl. Sedum rhodiola** De Candolle (1805); **incl. Sedum elongatum** Ledebour (1830) ≡ *Rhodiola elongata* (Ledebour) Fischer & C. A. Meyer (1841) ≡ *Sedum rhodiola* var. *elongatum* (Ledebour) Maximowicz (1883) ≡ *Sedum rosea* var. *elongatum* (Ledebour) Praeger (1921) ≡ *Rhodiola rosea* ssp. *elongata* (Ledebour) H. Jacobsen (1973); **incl. Sedum altaicum** G. Don (1834); **incl. Rhodiola sibirica** Sweet (1839); **incl. Sedum rhodiola** var. *crispum* Regel & Tiling (1858); **incl. Sedum rhodiola** var. *latifolium* Regel & Tiling (1858); **incl. Sedum rhodiola** var. *lingulatum* Regel & Tiling (1858); **incl. Sedum rhodiola** var. *oblongum* Regel & Tiling (1858) ≡ *Rhodiola rosea* var. *oblonga* (Regel & Tiling) H. Hara (1937); **incl. Sedum rhodiola** var. *viride* Regel & Tiling (1858); **incl. Sedum rhodiola** var. *vulgare* Regel & Tiling (1858) ≡ *Sedum rosea* var. *vulgare* (Regel & Tiling) Maximowicz ex Praeger (1921) ≡ *Rhodiola rosea* var. *vulgaris* (Regel & Tiling) H. Hara (1937); **incl. Sedum rhodiola** var. *linifolia* Regel & Schmalhausen (1878); **incl. Sedum rhodiola** var. *tachiroei* Franchet & Savatier (1878) ≡ *Sedum rosea* var. *tachiroei* (Franchet & Savatier) Praeger (1921) ≡ *Rhodiola tachiroei* (Franchet & Savatier) Nakai (1938) ≡ *Rhodiola rosea* var. *tachiroei* (Franchet & Savatier) H. Hara ex Honda (1957) (*nom. inval.*, Art. 33.2) ≡ *Rhodiola rosea* ssp. *tachiroei* (Franchet & Savatier) H. Jacobsen (1973); **incl. Sedum rhodiola** subvar. *continentale* Maximowicz (1883) ≡ *Sedum rosea* subvar. *continentale* (Maximowicz) Maximowicz ex A. Berger (1930); **incl. Sedum suboppositum** var. *telephioides* Maximowicz (1883) ≡ *Rhodiola telephioides* (Maximowicz) S. H. Fu (1980); **incl. Rhodiola lapponica** Gandoger (1886) (*nom. inval.*, Art. 24.1); **incl. Rhodiola scopoli** A. Kerner ex Simonkai (1887) ≡ *Sedum rhodiola* var. *scopoli* (A. Kerner ex Simonkai) Rouy & Camus (1901) ≡ *Rhodiola rosea* var. *scopoli* (A. Kerner ex Simonkai) Soó (1974); **incl. Sedum roanense** Britton (1903) ≡ *Rhodiola roanensis* (Britton) Britton (1903) ≡ *Sedum rosea* var. *roanense* (Britton) A. Berger (1930) ≡ *Rhodiola rosea* ssp. *roanensis* (Britton) H. Jacobsen (1973); **incl. Sedum caeruleans** Leveillé & Vaniot (1904); **incl. Rhodiola hideoi** Nakai (1938); **incl. Rhodiola maxima** Nakai (1938); **incl. Sedum rosea** var. *microphyllum* Fröderström (1938) ≡ *Rhodiola rosea* var. *microphylla* (Fröderström) S. H. Fu (1965); **incl. Rhodiola arctica** Borissova (1939) ≡ *Sedum arcticum* (Borissova) Rønning (1959) ≡ *Rhodiola rosea* ssp. *arctica* (Borissova) A. Löve (1961) ≡ *Sedum rosea* ssp. *arcticum* (Borissova) J. P. Kozhevnikov (1989); **incl. Rhodiola iremelica** Borissova (1939); **incl. Rhodiola sachalinensis** Borissova (1939) ≡ *Sedum sachalinense* (Borissova) Voroschilov (1966) ≡ *Rhodiola rosea* ssp. *sachalinensis* (Borissova) S. Gontcharova (1999); **incl.**

Rhodiola krivozhzhinii Siplivinsky (1974) $\equiv$ *Tolmachevia krivozhzhinii* (Siplivinsky) A. Löve & D. Löve (1976) $\equiv$ *Rhodiola rosea* ssp. *krivozhzhinii* (Siplivinsky) S. Gontcharova (1999).

[7] Dioecious, 5 - 50 cm tall; rhizomes cylindrical to long obconical, branched when well developed, 1 - 2 cm $\varnothing$; flowering stems 1 - 3 (-4 or more), 1 - 6 mm $\varnothing$, glabrous, smooth, pale green, sometimes glaucous; **L** remote throughout, widely spreading, sessile, oblong or obovate to oblanceolate or ovate, (0.4-) 1 - 3 (-4) $\times$ (0.3-) 0.6 - 1.7 (-2) cm, pale green, tip often tinged red, $\pm$ glaucous beneath, glabrous, smooth, tip round to acute, base shallowly cordate to truncate or round, sometimes amplexicaul, margin nearly entire to irregularly and sparsely serrulate; **Inf** 25- to 50- (to 70-) flowered, 1 - 2 (-3) $\times$ 2 - 4 (-5) cm $\varnothing$; **Ped** < 2 mm, smooth; **Fl** 3 - 7 mm $\varnothing$; **Cal** 2 - 2.5 mm, glabrous, lobes linear-subulate to narrowly triangular, 1.8 - 2.3 mm (male) or 2 - 2.7 mm (female), ascending; **Pet** yellow-green, linear to narrowly oblong (male) or linear-subulate (female), 2.5 - 3 (-3.5) mm (male) or 2.2 - 2.5 mm (female), widely spreading (male) or suberect (female); **St** longer than the **Pet**; **Fil** yellow, (3.5-) 4 - 5 mm; **Anth** yellow; **NSc** widely oblong, 0.7 - 1 mm; **Ca** 6 - 10 mm [2 - 3 mm (male)], tapering, each with 8 - 10 ovules; **Sty** slender, 0.7 - 1 mm; **Fr** with reflexed **Sty**; **Se** narrowly oblong, 1.2 - 1.4 mm, tip round, brown, longitudinally lowly ridged.

Vernacular name: "Roseroot".

R. saxifragoides (Fröderström) H. Ohba (J. Jap. Bot. 52(10): 305-306, 1977). **T**: Kashmir (*Perss* 706 [GB]). - **D**: Kashmir. **I**: Ohba (1980: 371).

$\equiv$ *Sedum saxifragoides* Fröderström (1936).

[2] Hermaphrodite, $\pm$ 2 cm tall; rhizomes obconical, 2 - 6 mm $\varnothing$; **Ros** 4 - 8 mm $\varnothing$ with 8 - 15 foliage **L**; radical **L** marcescent, oblong to ovate, 4 - 6 $\times$ 1.8 - 2.4 mm, glabrous, tip round, margin entire, petiole broadening towards base, 1 - 1.5 $\times$ 1.5 - 1.8 mm; flowering stem solitary, glabrous; **L** sessile, oblong, 2.5 - 3.2 $\times$ 1 - 1.5 mm, tip round, margin entire; **Inf** cymes with 1 - 3 erect **Fl**; **Ped** 1.5 - 2.2 mm; **Cal** 3.7 - 4.3 mm, lobes broadly oblong-ovate to broadly ovate, 3.5 - 3.8 mm; **Pet** oblong-lanceolate, probably white, 7.5 - 7.8 mm; **St** shorter than the **Pet**; **Anth** reddish (?); **NSc** transversally oblong, $\pm$ 0.6 mm; **Ca** 7 - 7.5 mm, each with 20 - 22 ovules; **Se** elliptic, tip round.

R. semenovii (Regel & Herder) Borissova (in Komarov & al. (eds.), Fl. URSS 9: 28, 1939). **T**: Turkistan (*Semenov* s.n. [LE, K]). - **D**: Kazakhstan, China (W Xinjiang); 1800 - 2900 m, flowers June to July. **I**: Praeger (1921a: 66, as *Sedum*).

$\equiv$ *Umbilicus semenovii* Regel & Herder (1866) $\equiv$ *Sedum semenovii* (Regel & Herder) Masters (1878) $\equiv$ *Cotyledon semenovii* (Regel & Herder) O. Fedtschenko & B. Fedtschenko (1909) $\equiv$ *Clementsia se-*

menovii (Regel & Herder) Borissova (1969); **incl.** *Rhodiola semenovii* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Umbilicus linifolius* Osten-Sacken & Ruprecht (1869); **incl.** *Umbilicus linearifolius* Franchet (1883); **incl.** *Sedum semenovii* var. *kansuense* Fröderström (1938) $\equiv$ *Rhodiola kansuensis* (Fröderström) S. H. Fu (1965).

[5] Hermaphrodite, to 60 cm tall; rhizomes cylindrical, 2 - 3 cm $\varnothing$, branching; flowering stems few, $\pm$ 6 mm $\varnothing$, glabrous; **L** sessile, linear, 3 - 7 cm $\times$ 2 - 4 mm, glabrous, tip acute, base round, margin entire or remotely serrate; **Inf** long dense spike-like racemes, 3 - 7 cm long; **Fl** shortly pedicellate or sessile; **Cal** deeply divided, lobes linear; **Pet** white or pink, lanceolate, 10 - 12 mm; **St** as long as the **Pet**; **Fil** white; **Anth** red; **NSc** square, $\pm$ 1 mm; **Fr** straight, $\pm$ 10 mm, turning red; **Se** $\pm$ 1 mm, narrowly ovoid, winged.

R. serrata H. Ohba (J. Jap. Bot. 52(9): 263-264, 1977). **T**: India, Assam (*Kingdon-Ward* 11980 [BM]). - **D**: E Himalaya: India (Assam), SE Tibet; forested slopes, near field borders, 3300 - 3800 m. **I**: Ohba (1981a: 87).

$\equiv$ *Sedum serratum* (H. Ohba) J. P. Kozhevnikov (1989).

[7] Dioecious, 25 - 60 cm tall; rhizomes thick; flowering stems 4 - 8 mm $\varnothing$, glabrous, smooth or papillate; **L** sessile, oblong to linear-oblanceolate, 7 - 13 $\times$ 2.5 - 4.5 cm, glabrous, tip acute, base $\pm$ auriculate, margin conspicuously serrate; **Inf** > 300-flowered; **Ped** 2 (-3) mm, papillate; **Fl** 5- or 6- (male) or 4- to 5-merous (female); **Cal** glabrous, deeply divided, lobes narrowly oblong (male) or subulate (female), $\pm$ 1 mm (male) or 1.7 - 2 mm (female); **Pet** greenish-yellow, oblanceolate (male) or linear (female), 2.2 - 2.5 mm (male) or 3 - 3.2 mm (female); **St** 2.2 - 2.6 mm; **Anth** yellow; **NSc** oblong, $\pm$ 0.8 mm; **Ca** 5 - 7 mm, each with 14 - 18 ovules; **Sty** 0.5 - 0.7 mm.

R. sherriffii H. Ohba (J. Jap. Bot. 53(9): 257-259, 1978). **T**: Tibet (*Ludlow & al.* 15394 [BM]). - **D**: E Himalaya (Sikkim, Bhutan), SE Tibet; thickets, grassy slopes, moist places, rocks, 4000 - 5000 m.

$\equiv$ *Sedum sherriffii* (H. Ohba) J. P. Kozhevnikov (1989).

[7] Dioecious, to 30 cm tall; rhizomes cylindrical, 1 - 2.5 cm $\varnothing$; flowering stems fastigiate, glabrous, smooth, 2 - 4 (-6) mm $\varnothing$; **L** ascending, sessile, oblanceolate to narrowly oblong, 1 - 3 cm $\times$ 2 - 7 mm, densely papillate on the upper face, tip acute, base attenuate, margin entire; **Inf** 40- to 100- (male) or 10- to 20-flowered (female), 2 - 4.5 cm $\varnothing$; **Ped** 2 - 8 mm, densely papillate; **Fl** 6 - 10 mm $\varnothing$; **Cal** 3 - 4.5 mm, glabrous, lobes narrowly oblong, 3 - 4.5 mm; **Pet** pale greenish-yellow, oblong-oblanceolate, 4 - 6 mm, spreading; **St** distinctly longer than the **Pet**; **Fil** 4.5 - 8 mm; **Anth** rose; **NSc** 0.5 - 0.8 mm; **Ca** 6 - 12 mm, each with $\pm$ 8 ovules; **Sty** $\pm$ 0.5

mm; **Se** elliptic, 3.5 - 4.2 mm, shortly tailed, brown, reticulate.

R. sinuata (Royle ex Edgeworth) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 127, 1965). **T:** India (*Herb. Royle* s.n. [LIV]). – **D:** Pakistan (Lahore), Kashmir, India (Kumaon), Nepal, Tibet, China (NW Yunnan); rock crevices and scree slopes, 3200 - 4300 m, flowers July to September. **I:** Ohba (1975: 335, as *Sedum*).

≡ *Sedum sinuatum* Royle ex Edgeworth (1846) ≡ *Sedum linearifolium* var. *sinuatum* (Royle ex Edgeworth) Hamet (1926); **incl.** *Sedum linearifolium* Royle (1839) ≡ *Rhodiola linearifolia* (Royle) S. H. Fu (1965) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum mucronatum* Edgeworth (1846); **incl.** *Sedum pauciflorum* Edgeworth (1846) ≡ *Sedum linearifolium* var. *pauciflorum* (Edgeworth) C. B. Clarke (1878); **incl.** *Sedum linearifolium* var. *genuinum* Hamet (1926) (*nom. inval.*, Art. 24.3); **incl.** *Sedum garwalicum* Fröderström (1942); **incl.** *Rhodiola fui* Borissova (1969).

[4] Hermaphrodite, 15 - 30 cm tall; rhizomes slender, creeping, 2 - 5 mm Ø, sparsely branched; flowering stems 1 - 5, yellowish-green; **L** widely spreading, sessile, narrowly oblanceolate to linear-oblanceolate, 1.5 - 3.5 × 0.15 - 1 (-2) cm, glabrous, tip acute, base long-attenuate, margin ± lobulate in the upper 1/3, papillate, lobes 3 (-5), linear, 2 - 10 × 0.8 - 2.2 mm, entire (to sinuate); **Inf** 3- to 13-flowered; **Fl** 8 - 18 mm Ø; **Ped** 3 - 6 mm, densely papillate; **Cal** 3 - 5.5 mm, glabrous, lobes ovate to triangular-lanceolate, 2 - 3.3 mm; **Pet** lanceolate to elliptic, white, 7 - 11 (-12) mm, spreading; **St** shorter than the **Pet**; **Anth** deep red-purple; **NSc** broadly oblong to square, 0.5 - 1 mm, deep to pale yellow; **Ca** 5 - 10 mm, pale green, each with 12 - 18 ovules.

R. smithii (Hamet) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 122, 1965). **T:** Sikkim (*Smith & Clave* 2126 [B, K, CAL]). – **D:** Nepal, Sikkim, S Tibet; sandy grasslands, gravelly places, rock crevices, 4000 - 5000 m, flowers late July to early September. **I:** Ohba (1975: 297, as *Sedum*).

≡ *Sedum smithii* Hamet (1913); **incl.** *Sedum chumbicum* Prain ex Hamet (1929) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum sangpo-tibetanum* Fröderström (1937) ≡ *Rhodiola sangpo-tibetana* (Fröderström) S. H. Fu (1965).

[3] Hermaphrodite, 2 - 5 cm tall; rhizomes 5 - 8 mm Ø, with dimorphic scaly **L**; scaly **L** triangular-ovate or triangular-semicircular, long acuminate or with linear appendage (1.5 - 3 mm) at the tip, 5 - 9 × 2 - 3.5 mm; flowering stems 2 - 3, ascending or suberect, from the **Ax** of the innermost scaly **L**, glabrous, 1.7 mm Ø; stem **L** remote, widely spreading, sessile, linear-elliptic or linear-ovate, 4.5 - 14 × 1.1 - 2.2 mm, glabrous, tip round, base truncate or very shortly attenuate, margin nearly entire; **Inf** small

corymbs with 5 - 10 **Fl**, 0.5 - 2.2 × 1 - 3.5 cm Ø; **Ped** 0.3 - 1.5 cm; **Fl** 4 - 5 mm Ø; **Cal** 3.1 - 5.3 mm, glabrous, lobes linear-ovate or very narrowly oblong, 2.4 - 4 mm; **Pet** linear-ovate, 3.7 - 6.5 mm, pink, ascending; **St** shorter than the **Pet**, erect; **Fil** reddish; **NSc** square, 0.4 - 0.6 mm, reddish; **Ca** 3.6 - 7.4 mm, each with 4 - 8 ovules; **Se** linear, tip rounded.

R. staminea (Paulsen) S. H. Fu (Fl. Reipub. Popul. Sin. 34(1): 220, 1984). **T:** Tibet (*Hedin* s.n. [S]). – **D:** Tibet.

≡ *Sedum stamineum* Paulsen (1922).

[4] Hermaphrodite (?), glabrous; flowering stems 4 - 6 cm tall, erect or ascending; **L** lanceolate, ± 7 mm, tip obtuse, base rounded, margins nearly entire; **Inf** with up to 17 **Fl**, umbellate; **Ped** very short or **Fl** almost sessile; **Fl** 5-merous; **Cal** lobes 5.3 mm, subulate; **Pet** pale purple, lanceolate or narrowly oblong, 5 mm, tip obtuse; **St** slightly longer than the **Pet**; **NSc** transversely oblong, tip emarginate; **Ca** shorter than **Pet** and **St**.

An uncertain species described from insufficient material without knowledge of female plants. It is somewhat similar to *R. dumulosa* in the shape of the nectar scales and petals, and possibly hermaphrodite flowers.

R. stapfii (Hamet) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 122, 1965). **T:** Tibet (*King* 318 [K, CAL]). – **D:** NE India (Assam), Bhutan, S Tibet; grassland slopes, 2900 - 5000 m, flowers in August. **I:** Ohba (1975: 302, as *Sedum*).

≡ *Sedum stapfii* Hamet (1913).

[8] Dioecious, to 3 cm tall; rhizomes 8 mm Ø; flowering stem solitary, erect, glabrous; **L** usually 5 or 6, nearly verticillate at or near the stem tip, glabrous, petiolate, ovate or oblong-ovate, 8 - 15 × 4 - 7 mm, tip obtuse, base round, margin entire, petiole 2 - 3.5 mm, broadening towards base; **Inf** 3- to 6-flowered, ebracteate; **Ped** 10 - 13 mm, glabrous; **Cal** 3.4 - 5 mm, glabrous, lobes slightly longer or shorter than the **Pet**; **Pet** narrowly oblong or narrowly oblong-ovate, white, 2.2 - 3.1 × 1 - 1.8 mm; **St** shorter than the **Pet**; **Fil** 1.8 - 2.3 mm; **Anth** reddish; **NSc** square to narrowly oblong, 0.6 - 0.8 mm, reddish; **Ca** 4.5 - 5.2 mm, tapering, each mostly with 8 ovules; **Sty** 0.8 - 1 mm; **Fr** nearly erect; **Se** 0.85 - 1 mm.

R. stephanii (Chamisso) Trautvetter & C. A. Meyer (in Middendorff, Reise Sibir. 1: 39, 1856). **T:** Siberia (*Redowsky* 8910 [B [Herb. Willdenow], E]). – **D:** Russia (E Siberia), China (N Nei Mongol). **I:** Ohba (1980: 390).

≡ *Sedum stephanii* Chamisso (1831) ≡ *Sedum crassipes* var. *stephanii* (Chamisso) Fröderström (1930) ≡ *Chamaerhodiola stephanii* (Chamisso) Nakai (1934) ≡ *Rhodiola crassipes* var. *stephanii*

(Chamisso) H. Jacobsen (1973); **incl.** *Sedum dentatum* Stephan ex Chamisso (1831) (*nom. inval.*, Art. 34.1c); **incl.** *Rhodiola pinnatifida* Borissova (1939) $\equiv$ *Sedum pinnatifidum* (Borissova) J. P. Kozhevnikov (1989); **incl.** *Rhodiola krylovii* Polozhij & Revjakina (1979).

[4] Monoecious or (?) hermaphrodite, 10 - 25 cm tall; rhizomes slender, creeping, sparsely branched, 0.5 - 1 cm $\varnothing$; flowering stems few, 2.5 - 4 mm $\varnothing$, glabrous; **L** ascending to spreading, sessile, oblanceolate to broadly oblanceolate, 2.5 - 4 $\times$ 0.6 - 1.2 cm, glabrous, tip obtuse to acute, base long attenuate, margin deeply to coarsely dentate; **Inf** 30- to 60-flowered, 1.5 - 2 $\times$ 2 - 5 cm $\varnothing$; **Ped** 2 - 8 mm, sparsely papillate; **Cal** glabrous, lobes narrowly triangular, 3 - 4.5 mm; **Pet** oblong-lanceolate to oblong-ovate, white, 5 - 6.5 mm, ascending (male) or suberect (female); **St** 4 - 4.4 mm [3.5 - 4 mm (female)]; **Anth** deep red (?); **NSc** usually square, $\pm$ 1 mm; **Ca** 7 - 8.5 mm [3.8 - 4.2 mm (male)], each with 6 - 8 ovules; **Se** linear-elliptic, $\pm$ 1.8 mm, with a short tail, yellowish-brown, longitudinally striate.

R. subopposita (Maximowicz) H. Jacobsen (Nation. Cact. Succ. J. 28(1): 6, 1973). **T** [syn]: China, Gansu (*Przewalski* 627+257 [LE]). – **D**: China (C Gansu, NE Qinghai); rocks in alpine areas, 3800 - 4100 m, flowers July.

$\equiv$ *Sedum suboppositum* Maximowicz (1883).

[7] Dioecious, to 30 cm tall with numerous flowering stems; **L** shortly petiolate to subsessile, opposite or in verticils of 3, or alternate, ovate to broadly elliptic, $\pm$ 2 $\times$ 1 cm, tip obtuse, base rounded, margins crenulate; **Inf** many-flowered, $\pm$ 1 cm $\varnothing$; **Ped** as long as the **Fl**; **Fl** 5-merous, $\pm$ 7 mm $\varnothing$; **Cal** lobes oblong; **Pet** yellow, oblong; **St** slightly longer than the **Pet**; **NSc** subquadrangular, tip emarginate; **Ca** ovate, rudimentary in male **Fl**; **Sty** short.

The identity of this taxon is still uncertain though it seems related to *R. rosea*.

R. tangutica (Maximowicz) S. H. Fu (Bull. Bot. Res., Harbin 6(4): 158, 1986). **T** [lecto]: China (*Przewalski* s.n. [LE, PE]). – **D**: China (Gansu, Qinghai, Sichuan); rock crevices in alpine areas, 2100 - 4700 m.

$\equiv$ *Sedum algidum* var. *tanguticum* Maximowicz (1883) $\equiv$ *Rhodiola algida* var. *tangutica* (Maximowicz) S. H. Fu (1980); **incl.** *Rhodiola gannanica* K.-T. Fu (1991).

[7] Dioecious, to 14 cm tall; rhizome branched, often massive; flowering stems 3 - 4 from each **Br**, persistent for 1 year after fruiting, $\pm$ 1.5 mm $\varnothing$, glabrous, smooth; **L** densely arranged, sessile, thickly herbaceous, 5 - 10 $\times$ 1 - 2 mm, linear to linear-lanceolate, widely spreading, glabrous, smooth, entire, tip obtuse, base round; **Inf** 3- to 9-flowered, nearly umbellate, 8 - 12 $\times$ 10 - 20 mm; **Ped** 2 - 4 mm (female) or **Fl** almost sessile (male);

Cal glabrous, tube conical, 2 - 3 mm, lobes triangular-ovate or narrowly oblong, $\pm$ 2 mm; **Pet** linear-lanceolate, 3 - 5 mm, pinkish; **St** slightly longer than the **Pet** (male); **Ca** 3 - 5 mm; **Sty** < 1 mm.

R. tibetica (Hooker fil. & Thomson) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 121, 1965). **T**: Tibet (*Thomson* s.n. [K]). – **D**: W Himalaya (Afghanistan, Pakistan, Kashmir, India [Himachal Pradesh]), SW Tibet; stony slopes, 4100 - 5400 m. **I**: Ohba (1982a: 144). **Fig. XXX.c**

$\equiv$ *Sedum tibeticum* Hooker fil. & Thomson (1858) $\equiv$ *Sedum quadrifidum* var. *tibeticum* (Hooker fil. & Thomson) Fröderström (1930) $\equiv$ *Chamaerhodiola tibetica* (Hooker fil. & Thomson) Nakai (1934); **incl.** *Sedum stracheyi* Hooker fil. & Thomson (1858) $\equiv$ *Sedum tibeticum* var. *stracheyi* (Hooker fil. & Thomson) C. B. Clarke (1878) $\equiv$ *Chamaerhodiola stracheyi* (Hooker fil. & Thomson) Nakai (1934).

[9] Dioecious, 7 - 25 cm tall; rhizomes cylindrical, to 1 cm $\varnothing$, often branching; flowering stems usually fastigiate, 1.5 - 2 mm $\varnothing$, marcescent, glabrous; **L** sessile, ascending, narrowly oblong to oblong-ovate, 5 - 12 $\times$ 2.5 - 4 mm, glabrous, smooth, tip acute to obtuse, base truncate to round, margin entire; **Inf** 20- to 40-flowered, 2 - 3 cm long and $\varnothing$; **Ped** < 4 mm, smooth; **Fl** 4 - 5 mm (male) or 5 - 6 mm (female) long; **Cal** 2.4 - 2.8 mm (male) or 3.4 - 4.2 mm (female), tube $\pm$ 1 mm (male) or 1.7 - 2 mm (female), lobes narrowly triangular to linear-lanceolate (male) or linear-subulate to linear-lanceolate (female), 1.4 - 1.7 mm (male) or 1.7 - 2.1 mm (female); **Pet** oblong (male) or narrowly oblong to oblong (female), purplish-red, 2.6 - 3 mm (male) or 2.3 - 3.2 mm (female), spreading (male) or ascending to suberect (female); **St** usually slightly longer than the **Pet**; **Anth** reddish; **NSc** oblong to very broadly oblong, 0.8 - 1 mm; **Ca** 6 - 9 mm [1.5 - 1.8 mm (male)], each with $\pm$ 16 ovules; **Fr** 8 - 10 mm, erect; **Se** 1.7 - 2.7 mm, linear to oblong, terminally shortly tailed, brown, longitudinally lowly striate, tip rounded.

R. wallichiana (Hooker fil.) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 125, 1965). **T**: Nepal (*Wallich* 7239 [K]). – **D**: Kashmir, N India, Bhutan, Nepal, Sikkim, Tibet, China (W Sichuan, W Yunnan); forests, rocks on slopes, 2500 - 3800 m, flowers mid-July to early September. **I**: Hooker (1844); Ohba (1975: 314, both as *Sedum*). **Fig. XXX.e**

$\equiv$ *Sedum wallichianum* Hooker fil. (1844); **incl.** *Sedum crassipes* Wallich ex Hooker fil. & Thomson (1858) $\equiv$ *Chamaerhodiola crassipes* (Wallich ex Hooker fil. & Thomson) Nakai (1934) $\equiv$ *Rhodiola crassipes* (Wallich ex Hooker fil. & Thomson) Borissova (1939); **incl.** *Sedum asiaticum* Clarke ex Hooker fil. (1878) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum crassipes* var. *cholaense* Praeger (1919) $\equiv$ *Rhodiola wallichiana* var. *cholaensis* (Praeger) S. H. Fu

(1965) = *Rhodiola crassipes* var. *cholaensis* (Praeger) H. Jacobsen (1973).

[4] Hermaphrodite, 15 - 30 cm tall; rhizomes cylindrical, 2 - 3 cm Ø; flowering stems fastigiate, glabrous, 3 - 6 mm Ø; **L** densely arranged throughout, sessile, linear to narrowly lanceolate, 1.2 - 3 cm × 1.2 - 6 mm, bright or yellowish-green above, pale green beneath, glabrous, tip obtuse, base long attenuate, margin remotely irregularly crenulate in the upper ½, nearly entire below; **Inf** 2 - 3.5 cm Ø; **Ped** 1 - 4 mm, papillate; **Cal** 6 - 8.5 mm, glabrous, lobes subulate, 5.6 - 8 mm; **Pet** pale greenish or yellowish-white, narrowly elliptic or linear, 7 - 11 mm, ascending or slightly spreading; **St** slightly shorter or longer than the **Pet**; **Fil** 7.5 - 12 mm; **Anth** dark purplish-red; **NSc** oblong, 1 - 1.2 mm; **Ca** 9 - 14 mm, slightly longer than the **Pet**, tapering, each with 28 - 36 ovules.

R. yunnanensis (Franchet) S. H. Fu (Acta Phytotax. Sin. 10 (Addit. 1): 126, 1965). **T:** China, Yunnan (*Delavay* 252 [P]). – **D:** India to SW China.

= *Sedum yunnanense* Franchet (1896).

R. yunnanensis ssp. *forrestii* (Hamet) H. Ohba (J. Fac. Sci. Univ. Tokyo, Sect. 3, Bot. 13(2): 126, 1982). **T:** China, Yunnan (*Forrest* 2384 [E]). – **D:** China (W Szechuan, NW Yunnan); slopes, 2900 - 4000 m. **I:** Ohba (1982a: 129).

= *Sedum yunnanense* var. *forrestii* Hamet (1912) = *Rhodiola forrestii* (Hamet) S. H. Fu (1965) = *Rhodiola yunnanensis* var. *forrestii* (Hamet) H. Jacobsen (1973); **incl.** *Sedum yunnanense* var. *muliense* Fröderström (1936) (*nom. inval.*, Art. 36.1); **incl.** *Sedum yunnanense* var. *oblanceolatum* Fröderström (1936) (*nom. inval.*, Art. 36.1); **incl.** *Sedum yunnanense* var. *papillocarpum* Fröderström (1936) (*nom. inval.*, Art. 36.1) = *Rhodiola papillocarpa* (Fröderström) S. H. Fu (1965); **incl.** *Sedum yunnanense* var. *strictum* Fröderström (1936) (*nom. inval.*, Art. 36.1).

[6] Differs from ssp. *yunnanensis*: **L** in verticils of 3 or 4, narrowly oblong to linear, margin crenulate, 1.9 - 4.4 × 0.4 - 1.1 cm, tip obtuse to round, base round to slightly cordate.

R. yunnanensis ssp. *yunnanensis* – **D:** India (Assam), SE Tibet, Myanmar, China (Gansu, Guizhou, Henan, Hubei, Shaanxi, Sichuan, Yunnan); forest slopes, 1000 - 4000 m. **I:** Praeger (1921a: 74-76, as *Sedum yunnanense* var. *valerianoides*); Ohba (1982a: 128).

Incl. *Sedum henryi* Diels (1900) = *Sedum yunnanense* var. *henryi* (Diels) Hamet (1929) = *Rhodiola henryi* (Diels) S. H. Fu (1965) = *Rhodiola yunnanensis* var. *henryi* (Diels) H. Jacobsen (1973); **incl.** *Sedum sinicum* Diels (1900) = *Rhodiola sinica* (Diels) H. Jacobsen (1973); **incl.** *Sedum valerianoides* Diels (1900) = *Sedum yunnanense* var. *valerianoides* (Diels) Hamet (1912) = *Rhodiola yunnan-*

sis var. *valerianoides* (Diels) H. Jacobsen (1973); **incl.** *Sedum mengtzeanum* Ulbrich ex Hamet (1929); **incl.** *Sedum yunnanense* var. *rotundifolium* Fröderström (1936) (*nom. inval.*, Art. 36.1) = *Rhodiola rotundifolia* (Fröderström) S. H. Fu (1965); **incl.** *Sedum yunnanense* var. *oxyphyllum* Fröderström (1942).

[6] Dioecious, 30 - 100 cm tall; rhizomes cylindrical, 0.5 - 2 cm Ø, sparsely branched when larger; flowering stems 1 (-3), 2 - 6 mm Ø, glabrous; **L** mostly ternate and verticils remotely arranged, sessile, ovate to oblong-ovate to rhombic-ovate, 2 - 14 × 1.2 - 6.8 cm, thickly herbaceous, glabrous, spreading, tip obtuse to acute, base round to attenuate or shallowly cordate, margin crenulate to nearly entire; **Inf** cymose-paniculate, 2 - 15 × 2 - 8 cm Ø; **Fl** 2.5 - 3.5 mm Ø; **Ped** 1.5 - 5 (-10) mm, smooth; **Cal** 1.5 - 2.5 mm, lobes linear-subulate to triangular, 0.6 - 1.2 mm, erect to suberect; **Pet** yellow-green, linear-obovate to oblanceolate (male) or triangular to narrowly triangular (female), 2.8 - 3.2 mm (male) or 0.6 mm (female), reflexed (male) or suberect (female); **St** shorter than the **Pet**; **Anth** deep red; **NSc** broadly oblong to square, 0.7 - 1 mm; **Ca** 3.5 - 4 mm, each with 14 - 20 ovules; **Sty** obliquely out-curved, ± 0.5 mm; **Fr** 4 - 5 mm with reflexed **Sty**; **Se** linear, ± 1.8 mm, brown, longitudinally lowly striate.

ROSULARIA

H. 't Hart

Rosularia (De Candolle) Stapf (CBM 149: t. 8985, in adnot., 1923). **T:** *Cotyledon sempervivum* M. Bieberstein [Lectotype, selected by A. Borissova, Novost. Syst. Vyssh. Rast. 6: 119, 1969.]. – **Lit:** Eggli (1988). **D:** E Mediterranean, Asia Minor, Near East, Karakorum - Himalaya, Altai. **Etym:** Lat. 'rosula', a small rose; the leaves are arranged in a rosette.

= *Umbilicus* Sect. *Rosularia* De Candolle (1828).

Dwarf perennial herbs, normally polycarpic (or rarely monocarpic), glabrous or glandular-hairy, often aromatic; **R** fibrous or thickened tap $\mathbf{R}$, or caudiciformly swollen; **Ros** stemless, flattened or globular, rarely with short stems, solitary or with sessile or prostrate-elongate offsets; **L** flat or keeled, ± succulent, oblong to broadly spatulate, margin entire, glandular-hairy, setate or denticulate; **L** sometimes dimorphic with differing summer and winter **L** and forming a resting **Ros** during the dry season; **Inf** lateral or terminal, upright or decumbent, drooping in bud or not, normally leafy below, glabrous or glandular-hairy, paniculate with cincinnoid or scorpioid lateral branches; **Fl** 5- or 5- to 9-merous, obdiplostemonous, urceolate, tubular to funnel-shaped, narrowly to broadly campanulate or star-like, sessile or more often pedicellate; **Pet** united basally for ¼ to ¾ of their length, white with

green or pink to red venation, or pale yellow, pink, pinkish-purple or pinkish-brown, dorsally glabrous or glandular-hairy, margin entire or rarely erose; **Fil** shorter than the **Pet** and basally united with them, first erect, later reclining; **Ca** upright, always much shorter than the **Cl**, slender or massive-voluminous, normally glandular-hairy along the upper ventral part, completely free or basally $\pm$ united and sunken into the **Rec**; **Fr** erect follicles splitting open in the upper part of the ventral suture; **Se** oblong-ellipsoid, pale to dark brown, with concolorous longitudinal striae, 0.5 - 1.3 mm.

The genus as recently monographed by Eggli (1988) (see 't Hart & Eggli (1988) for cytological details) is heterogeneous, as has been shown by molecular studies. Sect. *Chrysanthae* is referred to *Prometheum*, and Sect. *Sempervivella* to *Sedum*. The remaining species fall in 2 groups, of which Sect. *Ornithogalopsis* is probably misplaced in *Rosularia*, but it is presently retained for lack of a better understanding of its taxa. The group among *R. sempervivum* is taxonomically difficult and much confused in older literature; the treatment here follows Eggli (1988) and includes *R. persica* and *R. libanotica* within the circumscription of a variable *R. sempervivum*.

The following sections are recognized:

- [1] Sect. *Rosularia*: Caudex mostly lacking or in the form of an elongate thickened tap**R**; **Inf** lateral or rarely terminal, slenderly spicate or various but not corymbiform-paniculate; **Fl** urceolate to funnel-shaped, 5-merous; resting **Ros** frequent.
- [2] Sect. *Ornithogalopsis* A. Berger 1930: Caudex well developed, $\pm$ beetroot-shaped; **Inf** lateral, corymbiform-paniculate to spicate; **Fl** 5- to 9-merous; **Pet** whitish, with or without reddish venation.

The following names are of unresolved application but are referred to this genus: *Rosularia lipskyi* Borissova (1939); *Rosularia lutea* Borissova (1939); *Rosularia vvedenskyi* Prato (1974) (*nom. inval.*, Art. 29.1); *Sedum pseudosubtile* H. Hara (1965).

R. adenotricha (Wallich ex Edgeworth) Jansson (in K. H. Rechinger (ed.), Fl. Iranica 72: 29, 1970). **T**: India, Kumaon (*Binkworth* s.n. in Wallich 7231 [K, E, G]). – **D**: Afghanistan, Pakistan, India, Nepal, C Asia.

$\equiv$ *Sedum adenotrichum* Wallich ex Edgeworth (1846).

R. adenotricha ssp. **adenotricha** – **D**: Afghanistan, Pakistan, India, Nepal, 600 - 3500 m. **I**: Eggli (1988: 38). **Fig. XXX.f**

Incl. *Sedum griffithii* C. B. Clarke (1878); **incl.** *Cotyledon papillosa* Aitchison & Hemsley ex Aitchison (1880) $\equiv$ *Umbilicus papillosus* (Aitchison &

Hemsley ex Aitchison) Boissier (1888); **incl.** *Cotyledon tenuicaulis* Aitchison & Hemsley ex Aitchison (1880) $\equiv$ *Umbilicus tenuicaulis* (Aitchison & Hemsley ex Aitchison) Boissier (1888); **incl.** *Sedum anoxicum* Praeger (1919); **incl.** *Sedum adenotrichum* var. *genuinum* Hamet (1929) (*nom. inval.*, Art. 24.3); **incl.** *Sedum cuneatum* Wallich [ms.] ex Hamet (1929) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum adenocalyx* Blatter & Fernandez (1935).

[2] Caudex absent; **R** filiform; **Br** to 1.5 cm, $\pm$ thickened, with greyish-silvery smooth bark, branching and forming loose mats; **Ros** open, semiglobular, 1 - 1.5 cm $\varnothing$, offsets stalked; **L** oblong-spatulate, fleshy, to 18 mm, dark green, rarely pruinose, $\pm$ flushed purplish, margin entire or serrulate, apex rounded or obscurely pointed; **Inf** lax thyrses, lateral, drooping in bud, glabrous or upper $\frac{1}{2}$ glandular-hairy; **Fl** 5-merous, 5 - 6 mm, glabrous or glandular-hairy on the outer parts, tubular-campanulate, erect; **Ped** 2 - 10 mm, elongating after anthesis; **Pet** united for $\frac{1}{3}$, pale pink, yellowish-pink or rarely dirty white, venation often pinkish-red; **NSc** oblong-rectangular, pale yellowish-green. – [U. Eggli]

R. adenotricha ssp. **viguieri** (Hamet) Jansson (in K. H. Rechinger (ed.), Fl. Iranica 72: 30, 1970). **T**: Pakistan, Chitral (*Harris* 16154 [CAL, DD, O]). – **D**: Afghanistan, Pakistan, adjacent C Asia. **I**: Eggli (1988: 41).

$\equiv$ *Sedum adenotrichum* var. *viguieri* Hamet (1929) $\equiv$ *Sedum viguieri* (Hamet) Fröderström (1931); **incl.** *Rosularia hissarica* Borissova (1939); **incl.** *Sedum talichiense* Werdermann (1939).

[2] Differs from ssp. *adenotricha*: **Br** shorter or absent; **Ros** semiglobular or flattish, to 4 cm $\varnothing$; **L** spatulate with rounded apex, bright green, glandular-hairy and viscid; outside of **Fl** glandular hairy; **Pet** white. – [U. Eggli]

R. alpestris (Karelin & Kirilloff) Borissova (in Komarov & al. (eds.), Fl. URSS 9: 129, 1939). **T**: Kazakhstan (*Karelin & Kirilloff* 1488 [LE, G, OXF, W]). – **D**: C Asia, Himalaya.

$\equiv$ *Umbilicus alpestris* Karelin & Kirilloff (1842) $\equiv$ *Cotyledon alpestris* (Karelin & Kirilloff) O. & B. Fedtschenko (1909).

R. alpestris ssp. **alpestris** – **D**: Afghanistan, Pakistan, Kashmir, India, Tibet, C Asia, 1800 - 4500 m. **I**: Eggli (1988: 45).

Incl. *Sempervivum acuminatum* Decaisne (1844) $\equiv$ *Sedum acuminatum* (Decaisne) Hamet (1929) $\equiv$ *Sempervivella acuminata* (Decaisne) A. Berger (1930); **incl.** *Sempervivum mucronatum* Jacquemont ex Edgeworth (1846) $\equiv$ *Sempervivella mucronata* (Jacquemont ex Edgeworth) A. Berger (1930); **incl.** *Sedum moorcroftianum* Wallich ex Edgeworth (1846) (*nom. inval.*, Art. 34.1a); **incl.** *Sempervivum*

himalayense Klotzsch (1862); **incl.** *Sempervivum fimbriatum* Klotzsch (1862) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum umbilicoides* E. Regel (1877) $\equiv$ *Rosularia umbilicoides* (E. Regel) Borissova (1939); **incl.** *Sedum kokanicum* E. Regel & Schmalhausen *ex* E. Regel (1882) $\equiv$ *Rosularia kokanica* (E. Regel) Borissova (1939); **incl.** *Sedum olgae* E. Regel & Schmalhausen *ex* E. Regel (1882); **incl.** *Sedum durisii* Hamet (1913) $\equiv$ *Rhodiola durisii* (Hamet) S. H. Fu (1965); **incl.** *Sedum schlagintweitii* Fröderström (1931); **incl.** *Rosularia schischkinii* Borissova (1939); **incl.** *Rosularia tadzhikistana* Borissova (1939); **incl.** *Sedum scaphiophyllum* Werdermann (1939); **incl.** *Sedum nuristanicum* Kitamura (1958) $\equiv$ *Rhodiola nuristanica* (Kitamura) H. Jacobsen (1973); **incl.** *Sempervivella mucronata* var. *glabra* Kitamura (1960).

[3] **R** a well-developed turbinate-irregular caudex with several tap**R**; **Ros** flat to semiglobular, cone-shaped during the resting-period, 3 - 6 cm $\varnothing$, offsets on $\pm$ elongate **L**less stalks, or subsessile; **L** linear-oblong to obovate, strongly mucronate, very fleshy, light green (ochre and papery when dry), glabrous, sometimes slightly pruinose, margin with few to many translucent ciliae; **Inf** corymbiform lateral panicles, densely head-like at anthesis (axis later elongating); **Fl** 6- to 9-merous, glabrous (except **Ca**), saucer-shaped and star-like; **Pet** ovate, united for the basal $\frac{1}{2}$ or less, white to pale pinkish, often with dark purplish venation, apex often distinctly aristate; **NSc** $\pm$ square, often slightly emarginate, succulent, white; **Ca** plump, light green, **Sty** distinctly offset.

This is a very variable taxon, but despite the many synonyms, no infraspecific entities can be recognized with the exception of ssp. *marnieri*. This taxon is reliably winterhardy. – [U. Eggli]

R. alpestris ssp. *marnieri* (Hamet *ex* H. Ohba) Eggli (Bradleya 6: Suppl.: 47, ill. (p. 48, 53), 1988). **T**: Nepal (*Lowndes* 1506 [BM, E, TI]). – **D**: India, Nepal, 3000 - 4800 m. **Fig. XXX.d**

$\equiv$ *Sedum marnieri* Hamet *ex* H. Ohba (1974) $\equiv$ *Rosularia marnieri* (Hamet *ex* H. Ohba) H. Ohba (1977).

[3] Differs from ssp. *alpestris*: **L** oblong to slender ovoid, fairly succulent, bright grass-green, glabrous or almost, margin with few short ciliae; **Fl** normally 6-merous, $\pm$ funnel-shaped; **Pet** white or pale pinkish, basally greenish, with or without purplish venation, margin strongly erose in the upper $\frac{1}{2}$; **Ca** slender. – [U. Eggli]

R. blepharophylla Eggli (KuaS 38(6): 134-135, (8): (81) [erratum], ill., 1987). **T**: Turkey, Diyarbakir (Eggli 851 [Z, ISTE, ZSS]). – **D**: SE Turkey (on limestone). **I**: Eggli (1988: 50).

[1] **Ros** with thickened tap**R**, semiglobular, 2 - 4 cm $\varnothing$, with (sub-) sessile offsets; **L** $\pm$ erect, oblong with rounded to truncate apex, 2 - 3 cm, narrowest

at the base, green, glabrous or with scattered glandular **Ha**, margin ciliate; **Inf** lateral, drooping when young, 8 - 15 cm, branched, basally with large **Bra**; **Fl** 5-merous, erect, broadly tubular; **Sep** slender triangular, green; **Pet** 10 - 12 mm, white with greenish venation, rarely flushed pale pinkish.

Only known from the type locality; closely related to *R. lineata*. – [U. Eggli]

R. davisii Muirhead (Notes Roy. Bot. Gard. Edinburgh 31: 393, 1972). **T**: Turkey, Hakkari (*Davis* 45680 [E]). – **D**: SE Turkey, 2900 - 3000 m. **I**: Eggli (1988: 55).

[1] Caudex 5 - 8 mm $\varnothing$, short or several cm long, frequently branched; **Ros** semiglobular, 0.5 - 1.5 cm $\varnothing$, in dense clumps; **L** oblong-spatulate to oblong-truncate, 3 - 11 $\times$ 1.8 - 2 mm, glabrous, glaucous greenish-blue, apically rather succulent, margin entire or slightly papillate; **Inf** lateral, 1- to 3-flowered, at least upper $\frac{1}{2}$ glandular-hairy; **Fl** 5-merous, 6 - 7 mm, narrowly funnel-shaped; **Pet** united for $\frac{2}{3}$, whitish; **Ca** slender. – [U. Eggli]

R. elymaitica (Boissier & Haussknecht) A. Berger (NPF2 18a: 465, 1930). **T**: Iran (*Haussknecht* s.n. [G, JE, LE, W]). – **D**: SE Turkey, NW Iran, Turkmenistan, 1800 - 2800 m. **I**: Eggli (1988: 56).

$\equiv$ *Umbilicus elymaiticus* Boissier & Haussknecht (1872) $\equiv$ *Cotyledon elymaitica* (Boissier & Haussknecht) Bornmüller (1914) $\equiv$ *Sedum elymaiticum* (Boissier & Haussknecht) Hamet (1929).

[1] Caudex turbiniform to 8 mm $\varnothing$, passing into the long thick tap**R**; **Ros** flat, 2 - 7 cm $\varnothing$, mostly solitary; **L** oblong-spatulate with rounded or subtruncate apex, 13 - 32 mm with very narrow base, broadest near apex, completely glabrous, pale blue-green, glaucous, margins whitish and serrate-denticulate; **Inf** terminal thyrses with lateral helioid branches, 25- to 250-flowered, to 50 cm; **Fl** 5-merous, $\pm$ cup-shaped, 4 - 6 mm, outer parts densely glandular-hairy; **Pet** united for $\frac{1}{3}$ - $\frac{1}{2}$, white with pink venation, or pale pink, apex mucronulate; **NSc** rectangular-oblong to 1.1 mm; **Ca** massive with very short **Sty**. – [U. Eggli]

R. glabra (E. Regel & Winkler) A. Berger (NPF2 18a: 466, 1930). **T**: Tadzhikistan?, "Turkestan" (*Regel* s.n. [lecto - icono: Gartenflora 29: t. 1019, 1888]). – **D**: C and N Afghanistan, adjacent Turkmenistan and Tadzhikistan, 1100 - 2300 m. **I**: Eggli (1988: 58).

$\equiv$ *Umbilicus glaber* E. Regel & Winkler (1879) $\equiv$ *Cotyledon glabra* (E. Regel & Winkler) O. & B. Fedtschenko (1909); **incl.** *Cotyledon ferganica* Drobow *ex* Borissova (1939) (*nom. inval.*, Art. 34.1a).

[2] Caudex massive, 1 - 4.5 cm $\varnothing$, turbinate to turnip-shaped with several long thickened taproots; **Ros** flattish, 3 - 11 cm $\varnothing$, normally solitary; **L** oblong-truncate to spatulate, 1.7 - 4.5 cm, broadest near apex, base normally dilatated, glabrous, very

fleshy (papery thin and pale ochre when dry), margins finely serrulate; **Inf** lateral richly branched stout panicles, 10 - 30 cm, with helicoid **Br** in the upper $\frac{1}{2}$ - $\frac{3}{4}$, glabrous or with occasional short glandular **Ha**; **Fl** 6- to 7-merous, broadly funnel-shaped, glabrous; **Pet** 4.5 - 5.8 mm, united for $\frac{1}{8}$ - $\frac{1}{6}$, brownish-green to greenish-white, apex mucronate; **Ca** slender to massive. – [U. Eggli]

R. globulariifolia (Fenzl) A. Berger (NPF2 18a: 465, 1930). **T**: Turkey, Hatay (*Kotschy* 203 [W]). – **D**: SW, S and SE Turkey, N Cyprus, NW Syria, W coastal Lebanon; on limestone, to 1400 m. **I**: Eggli (1988: 61). **Fig. XXXIa**

≡ *Umbilicus globulariifolius* Fenzl (1842) ≡ *Cotyledon globulariifolia* (Fenzl) Baker (1870) ≡ *Sedum globulariifolium* (Fenzl) Hamet (1929); **incl.** *Umbilicus libanoticus* var. *convivens* Post (1896); **incl.** *Umbilicus cyprius* Holmboe (1914) ≡ *Rosularia cypria* (Holmboe) Meikle (1977).

[1] Caudex absent, with thickened tap**R**; **Ros** flattish, solitary or with few subsessile to stalked offsets, 3 - 11 cm Ø; **L** oblong-spatulate with truncate to rounded apex, 1.5 - 5 cm, narrowest near the base, somewhat fleshy, fresh green, completely covered by dense glandular **Ha**, viscid and with resinous scent; **Inf** lateral or (in cultivation) mostly terminal slender pyramidal to spicate panicles, 10 - 40 cm, lower part leafy; **Fl** 5-merous, semiglobular to urceolate; **Pet** 5 - 7.5 mm, united for $\frac{1}{3}$ - $\frac{1}{2}$, whitish to ivory or pale pink; **NSc** 0.75 - 1.1 mm, $\frac{1}{2}$ as broad; **Ca** slender to massive, pale greenish.

This striking taxon appears to flower laterally for several years in nature before finally producing a terminal inflorescence to die subsequently. Under cultivation, the rosettes are monocarpic, and the flowers are self-pollinating.

A recent report of this taxon from Iran (Akhiani 2000) is improbable and needs confirmation. – [U. Eggli]

R. haussknechtii (Boissier & Reuter) A. Berger (NPF2 18a: 466, 1930). **T**: Turkey, Urfa (*Haussknecht* 893 [JE, B, BM, JE, LE]). – **D**: SE Turkey (inland), 1200 - 2300 m. **I**: Eggli (1988: 63).

≡ *Umbilicus haussknechtii* Boissier & Reuter (1872) ≡ *Cotyledon haussknechtii* (Boissier & Reuter) Bornmüller (1938).

[1] Caudex none or well-developed, to 1 cm Ø; **Ros** ± flattish or semiglobular, 0.5 - 3 cm Ø, solitary or with a few subsessile offsets; **L** oblong- to linear-spatulate with rounded or truncate apex, 8 - 18 mm, broadest near apex or strap-shaped, dull or fresh green, lamina glabrous or glandular-hairy, margins with long whitish-transparent comb-like ciliae to 0.7 mm; **Inf** few-flowered reduced lateral thyrses, 4 - 8 cm; **Fl** 5-merous, 7 - 9 mm, tubular, outer parts glandular-hairy; **Pet** united for $\frac{2}{5}$ - $\frac{3}{4}$, pale pink with mucronate reflexed apex; **NSc** square or suborbicular, 0.3 mm broad; **Ca** slender.

A taxon with unclear affinities, but clearly belonging to the *R. sempervivum* aggregate. – [U. Eggli]

R. lineata (Boissier) A. Berger (NPF2 18a: 466, 1930). **T**: Syria (*Boissier* s.n. [G, K, LE, O, UPS]). – **D**: Lebanon, Syria, Jordania, Israel **I**: Eggli (1988: 69). **Fig. XXXIb**

≡ *Umbilicus lineatus* Boissier (1847) ≡ *Umbilicus libanoticus* var. *lineatus* (Boissier) Post (1896) ≡ *Cotyledon lineata* (Boissier) Dinsmore (1932) ≡ *Rosularia sempervivum* var. *lineata* (Boissier) Thiébaud (1940); **incl.** *Rosularia setosa* Bywater (1979).

[1] Caudex turnip-shaped, passing into massive tap**R**; **Ros** flattish, 2 - 7 cm Ø, normally solitary, occasionally with few (sub-) sessile offsets; **L** elongate-spatulate with rounded or truncate apex, somewhat to very fleshy, medium to dark green, lamina ± glandular-hairy, margin glandular-hairy and with long eglandular ciliae; **Inf** lateral thyrses, ovoid in outline, densely glandular-hairy, lower part with densely imbricate and often enlarged **Bra**; **Fl** mostly unilateral in coiled **Br**, 5-merous, 8 - 10 (-12) mm, broadly tubular, outer parts densely glandular-hairy, often with distinctly musky smell; **Pet** united for $\frac{1}{2}$ - $\frac{3}{5}$, slightly keeled, pink with darker venation, basally greenish, apex strongly reflexed; **NSc** ± square, pale greenish to yellowish, fleshy; **Ca** broad and massive, pale greenish. – [U. Eggli]

R. modesta (Bornmüller) Parsa (Fl. Iranica, Suppl. Gen., 115, 1952). **T**: Iran, Prov. Kerman (*Bornmüller* s.n. = 3567 [JE, B]). – **D**: Afghanistan, Iran.

≡ *Cotyledon modesta* Bornmüller (1938).

R. modesta var. *linearifolia* (Jansson) Eggli (Bradleya 6: Suppl.: 72, ills. (p. 73), 1988). **T**: Afghanistan, Kabul (*Rechinger* 18551 [W, E, G]). – **D**: C, S and E Afghanistan, isolated in SE Iran, 1000 - 3000 m.

≡ *Rosularia adenotricha* ssp. *linearifolia* Jansson (1970).

[1] Differs from var. *modesta*: **Ros** smaller, 1 - 2 cm Ø, flattish; **L** linear-oblong with rounded apex, 8 - 21 × 1 - 3 mm, glabrous except upper part of lamina, margins with scattered cilia and glandular **Ha**. – [U. Eggli]

R. modesta var. *modesta* – **D**: Afghanistan, adjacent E Iran, 750 - 2000 m. **I**: Eggli (1988: 71).

Incl. *Rosularia sessiliflora* Jansson (1966).

[1] Caudex consisting of thickened tap**R** and lower stem axis, 3 - 7 mm Ø and several cm long; **Ros** flattish, 1.5 - 4 cm Ø, solitary or offsetting; **L** broadly or rarely linearly spatulate with rounded apex, 1 - 2.5 cm with narrow base, bluish-green but not glaucous, glabrous, margin rarely whitish-horny, otherwise laxly to densely ciliate; **Inf** lateral racemose thyrses, 4 - 13 cm, upper $\frac{1}{2}$ glandular-

hairy; **Fl** 5-merous, 5 - 6 mm, $\pm$ urceolate, outside glandular-hairy; **Pet** united for $\frac{1}{3}$ - $\frac{2}{3}$, slightly fleshy, dirty whitish to pinkish; **NSc** square or oblong; **Ca** massive, deeply immersed into the **Rec** tissue, and basally slightly connate. – [U. Eggli]

R. pallidiflora (Holmboe) Meikle (Fl. Cyprus 1: 645, 1977). **T:** Cyprus (*Holmboe* 824b [O]). – **D:** N Cyprus, S coastal Turkey (?) **I:** Eggli (1988: 74).

$\equiv$ *Umbilicus pallidiflorus* Holmboe (1914).

[1] Caudex small or none, tap**R** to 7 mm $\varnothing$; **Ros** flattish, 2.5 - 7 cm $\varnothing$, solitary or clump-forming with subsessile offsets; **L** oblong-spatulate with rounded apex, 2.3 - 3.2 cm, slightly fleshy, medium green (dark brown when dry), glabrous or with scattered glandular **Ha**, margin whitish-horny, finely denticulate, or glandular-hairy; **Inf** compact or lax ovoid lateral thyrses, 6 - 12 cm, upper $\frac{1}{2}$ glandular-hairy; **Fl** 5-merous, semiglobular to urceolate, glandular-hairy; **Pet** 4 - 7 mm, united for $\frac{2}{5}$ - $\frac{3}{5}$, yellowish-white or white; **NSc** oblong-rectangular, $\pm$ 0.75 mm; **Ca** massive, with a short **Sty**.

Closely related to *R. globulariifolia*. Plants with intermediate characters have been recorded from Cyprus. – [U. Eggli]

R. platyphylla (Schrenk) A. Berger (NPF2 18a: 466, 1930). **T:** Kirgizia, Alatau (*Schrenk* s.n. [LE]). – **D:** China (NW Sinkiang), Kazakhstan, Kirgizia. **I:** Eggli (1988: 75). **Fig. XXXI.c**

$\equiv$ *Umbilicus platyphyllus* Schrenk (1841) $\equiv$ *Cotyledon platyphylla* (Schrenk) O. & B. Fedtschenko (1909) $\equiv$ *Sedum platyphyllum* (Schrenk) Hamet (1929); **incl.** *Umbilicus pulvinatus* Ruprecht (1869) $\equiv$ *Cotyledon pulvinata* (Ruprecht) O. & B. Fedtschenko (1909) (*nom. illeg.*, Art. 53.1); **incl.** *Umbilicus turkestanicus* E. Regel & Winkler (1879) $\equiv$ *Cotyledon turkestanica* (E. Regel & Winkler) O. & B. Fedtschenko (1909) $\equiv$ *Rosularia turkestanica* (E. Regel & Winkler) A. Berger (1930); **incl.** *Cotyledon dubia* C. Winkler ex Borissova (1939) (*nom. inval.*, Art. 34.1a); **incl.** *Rosularia borissovae* Pratov (1974).

[2] Caudex massive, turnip- to beetroot-shaped, to 2.5 cm $\varnothing$, extending into several thick tap**R**; **Ros** flat, 2 - 12 cm $\varnothing$, mostly solitary; **L** broadly linear with tapering, acute or $\pm$ triangular apex, 1 - 6.5 cm, broadest near apex, basally slightly dilatated, fresh green (pale ochre when dry), densely short glandular-hairy; **Inf** lateral racemose thyrses, lax or corymbiform with **Fl** in the upper $\frac{1}{3}$ only, 6 - 20 cm; **Fl** 5- (to 6-) merous, 5 - 7 mm, broadly funnel- to saucer-shaped, glabrous or outside glandular-hairy, **Pet** 5 - 7 mm, united for $\frac{1}{3}$ - $\frac{1}{2}$, whitish (straw-coloured when dry); **Ca** massive, basally connate, with distinctly offset **Sty**.

Closely related to *R. alpestris*, with which it shares the compact corymbiform inflorescence, which elongates during the ripening of the fruits. – [U. Eggli]

R. radicata (Boissier & Hohenacker) Eggli (Bradleya 6: Suppl.: 76, ill. (p. 77), 1988). **T:** Iran (*Kotschy* 606 [G, UPS]). – **D:** C Afghanistan, N Iran, S Kirgizia, Kazakhstan, Turkmenistan; 1500 - 2300 m.

$\equiv$ *Sedum radicosum* Boissier & Hohenacker (1849); **incl.** *Rosularia tianschanica* Sumr. & Korot (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Umbilicus paniculatus* E. Regel & Schmalhausen (1878) $\equiv$ *Cotyledon paniculata* (E. Regel & Schmalhausen) O. & B. Fedtschenko (1909) (*nom. illeg.*, Art. 53.1) $\equiv$ *Rosularia paniculata* (E. Regel & Schmalhausen) A. Berger (1930); **incl.** *Umbilicus subspicatus* Freyn (1906) $\equiv$ *Cotyledon subspicata* (Freyn) O. & B. Fedtschenko (1909) (*nom. illeg.*, Art. 53.1) $\equiv$ *Rosularia subspicata* (Freyn) Borissova (1939); **incl.** *Umbilicus racemosus* Freyn (1906) (*nom. inval.*, Art. 32.1).

[2] Caudex massive, depressed beetroot-shaped, 1.2 - 4.7 cm $\varnothing$, with 1 to several thickened tap**R**; **Ros** flattish, 2.5 - 15 cm $\varnothing$, mostly solitary; **L** spatulate to obtrullate with rounded, round-triangular or pointed apex, 1 - 7 cm, basally broadened, very succulent, dull dark green, often tinged bronze or purplish (ochre-brownish when dry), glabrous, margin glabrous or with occasional short cilia; **Inf** lateral stoutly erect spicate racemes, glabrous to puberulent, 10 - 40 cm; **Fl** 5- to 6-merous, $\pm$ saucer-shaped, glabrous, **Pet** 4 - 5.5 mm, united for $\frac{1}{15}$ - $\frac{1}{5}$, brownish-pink or dirty whitish; **NSc** suborbicular to $\pm$ square; **Ca** massive, basally connate, with clearly offset **Sty**. – [U. Eggli]

R. xreginae Eggli (Bradleya 6: Suppl.: 90, ill. (p. 60), 1988). **T:** Turkey, Içel (*Eggli* 812 [Z, ZSS]). – **I:** Eggli (1988: 60).

[1] **Ros** solitary, to 7 cm $\varnothing$, flattish; **L** spreading with upturned tips, richly blue-green, farinose; **Inf** terminal, erect or weakly semi-erect, to 15 cm.

This attractive taxon is intermediate between its supposed parents *R. globulariifolia* and *R. sempervivum* ssp. *glaucophylla*, except for the solitary rosettes with the terminal inflorescence. It appears to come true from seed (which forms by self-pollination), which casts some doubt on its proposed hybrid status. – [U. Eggli]

R. rosulata (Edgeworth) H. Ohba (J. Jap. Bot. 52(1): 9-11, 1977). **T:** India, Himalaya (*Edgeworth* 107 [K, OXF]). – **D:** N India (Himachal Pradesh, N Uttar Pradesh), Nepal, Sikkim; 1700 - 3000 m. **I:** Eggli (1988: 81).

$\equiv$ *Sedum rosulatum* Edgeworth (1846); **incl.** *Umbilicus radicans* Klotzsch (1862); **incl.** *Sedum pyriforme* Royle ex Hamet (1929) (*nom. inval.*, Art. 34.1c).

[1] Caudex absent, tap**R** hardly thickened; **Ros** flat, very open, with few (5 - 10) **L**, 1 - 3 cm $\varnothing$, offsetting with thin stems several cm long; **L** distinctly spatulate, 0.7 - 1.8 cm with basal narrow claw,

hardly succulent (paper-thin when dry), medium green, glabrous, margin whitish-horny and slightly crenulate; **Inf** lateral reduced panicles or thyrses, 3- to 10-flowered, 3 - 8 cm, prostrate to erect; **Fl** 5-merous, normally glabrous, saucer- to funnel-shaped; **Pet** 3.7 - 4 mm, united for $\frac{1}{10}$, white to ivory; **NSc** oblong-rectangular; **Ca** thickish-plump, **Sty** distinctly offset. – [U. Eggli]

R. sempervivum (M. Bieberstein) A. Berger (NPF2 18a: 466, 1930). **T:** Caucaus (*Bieberstein* s.n. [LE?, E photo]). – **D:** Widespread from W Asia to Iran and the Caucasus; on various substrates.

≡ *Cotyledon sempervivum* M. Bieberstein (1789) ≡ *Umbilicus sempervivum* (M. Bieberstein) De Candolle (1828) ≡ *Sedum sempervivum* (M. Bieberstein) Hamet (1929) (*nom. illeg.*, Art. 53.1).

The infraspecific classification here adopted follows Eggli (1988), but has to be treated as rather informal, and intermediates between the various named segregates are not infrequently encountered. Only a large-scale biosystematic study can bring more light into the intricate relationships within this geographically widespread taxon.

R. sempervivum ssp. **amanensis** Eggli (KuaS 38(6): 135-136, ill., 1987). **T:** Turkey, Hatay (*Haradjan* 536 [G, E, G, K]). – **D:** SE coastal Turkey. **I:** Eggli (1988: 88).

[1] **Ros** flat, 4 - 8 cm Ø, with offsets stalked 2 - 5 cm; **L** narrowly oblong-spatulate, 2.5 - 5.5 cm with a long basal 'claw' 1 - 3 mm broad, suddenly widening near the rounded apex, dark green, never glaucous, densely glandular-hairy and with strong resinous scent; **Inf** lateral thyrses to 30 cm, often decumbent, drooping when young; **Fl** 5-merous, 7 - 8 mm, slender-tubular; **Pet** united for $\frac{1}{2}$, white or pale pink, with greenish or rarely pinkish venation. – [U. Eggli]

R. sempervivum ssp. **glaucophylla** Eggli (KuaS 38(6): 136-137, ill., 1987). **T:** Turkey, Maras (*Davis* 19947 [E, BM, K]). – **D:** S Turkey; on limestone, 1200 - 2200 m. **I:** Eggli (1988: 90). **Fig. XXXI.e**

Incl. *Rosularia spatulata* hort. plur. angl. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Cotyledon pestalozzae* var. *glaberrima* Bornmüller (1941) ≡ *Rosularia pestalozzae* var. *glaberrima* (Bornmüller) Chamberlain & Muirhead (1972) (*nom. inval.*, Art. 34.1a).

[1] **Ros** with a regularly to irregularly thickened tapR to several cm long, flattish, 3 - 6 cm Ø, mostly with several short-stalked (< 2 cm) offsets; **L** oblong to broadly spatulate, 1.5 - 3 cm, bluish-glaucous, young farinose, always glabrous, apex rounded, margin distinctly denticulate or serrulate, whitish-horny; **Inf** lateral thyrses, drooping when young, to 25 cm, slender, often glandular-hairy and viscid; **Fl** 5-merous, 7 - 9 mm, glabrous or rarely glandular; **Pet** pale pink, apically reflexed.

Sometimes intergrading with ssp. *pestalozzae*, but mostly easily distinguished on account of the bluish-glaucous flattish rosettes. – [U. Eggli]

R. sempervivum ssp. **kurdica** Eggli (Bradleya 6: Suppl.: 91, ill. (p. 92), 1988). **T:** Iraq (*Bornmüller* 1217 [JE, B, K, LE, W]). – **D:** SE Turkey, adjacent Iran and Iraq, Armenia, Azerbaidzhan.

Incl. *Umbilicus libanoticus* var. *steudelii* Boissier (1872) ≡ *Cotyledon libanotica* var. *steudelii* (Boissier) Parsa (1948); **incl.** *Umbilicus libanoticus* fa. *major* Bornmüller (1911) ≡ *Cotyledon libanotica* fa. *major* (Bornmüller) Parsa (1948); **incl.** *Cotyledon libanotica* var. *kurdica* Bornmüller (1938) (*nom. inval.*, Art. 32.1c) ≡ *Rosularia radiceflora* ssp. *kurdica* (Bornmüller) Chamberlain & Muirhead (1972) (*nom. inval.*, Art. 43.1).

[1] Similar to ssp. *persica*, but **Ros** larger (to 10 cm Ø); **Fl** yellowish. – [U. Eggli]

R. sempervivum ssp. **libanotica** (Labillardière) Eggli (Bradleya 6: Suppl.: 93, ill. (p. 94), 1988). **T:** Lebanon (*Labillardière* s.n. [FI]). – **D:** S Turkey, W Syria, Lebanon, W Jordania, Israel; to 2000 m.

≡ *Cotyledon libanotica* Labillardière (1809) ≡ *Umbilicus libanoticus* (Labillardière) De Candolle (1828) ≡ *Rosularia sempervivum* var. *libanotica* (Labillardière) Thiébaud (1940) ≡ *Rosularia libanotica* (Labillardière) Muirhead (1972); **incl.** *Umbilicus libanoticus* var. *pauciflorus* Boissier (1888); **incl.** *Rosularia parvifolia* Fröderström & Samuelsson ex Rechinger (1951); **incl.** *Rosularia libanotica* var. *pubescens* Fröderström ex Samuelsson (1960) (*nom. inval.*, Art. 43.2); **incl.** *Rosularia kesrouanensis* Mouterde (1970).

[1] **Ros** flattish or with ± semierect **L**, 2.5 - 9 cm Ø, offsets sessile or 2 - 3 cm stalked; **L** oblong-truncate to spatulate with round or emarginate apex, fresh green, never glaucous, 2 - 4 cm, densely glandular-hairy and with resinous scent, margin glandular or slightly denticulate; **Inf** lateral, 10 - 20 cm; **Fl** 7 - 10 mm, funnel-shaped and opening ± widely; **Pet** pale pink with slightly darker venation.

Reminiscent of ssp. *pestalozzae*, but readily distinguished by its larger and more widely opening flowers. *R. kesrouanensis* is tentatively included here as a synonym; it is only known from the type and seems to represent a diminutive form of this taxon. – [U. Eggli]

R. sempervivum ssp. **persica** (Boissier) Eggli (Bradleya 6: Suppl.: 95, ill. (p. 96), 1988). **T:** Iran (*Aucher-Eloy* 4522 [G, BM, G, K, LE, W]). – **D:** SE, E and NE Turkey, SW Syria, Lebanon, Israel, NW and W Iran, NE Iraq, Armenia, Azerbaidzhan; 100 - 3000 m. **Fig. XXXI.f**

≡ *Umbilicus persicus* Boissier (1843) ≡ *Cotyledon persica* (Boissier) Bornmüller (1914) ≡ *Rosula-*

ria persica (Boissier) A. Berger (1930) $\equiv$ *Sedum persicum* (Boissier) Hamet (1958) (*nom. inval.*, Art. 33.2); **incl.** *Umbilicus libanoticus* var. *glaber* Boissier (1872) $\equiv$ *Sedum sempervivum* var. *glabrum* (Boissier) Hamet (1929) (*nom. inval.*, Art. 43.1) $\equiv$ *Cotyledon libanotica* var. *glabra* (Boissier) Parsa (1948) $\equiv$ *Rosularia radiculiflora* ssp. *glabra* (Boissier) Chamberlain & Muirhead (1972) (*nom. inval.*, Art. 43.1) $\equiv$ *Rosularia sempervivum* var. *glabra* (Hamet) Assadi (2000) (*nom. inval.*, Art. 33.3 / 33.6); **incl.** *Umbilicus radiculiflorus* Steudel ex Boissier (1872) (*nom. inval.*, Art. 34.1a); **incl.** *Umbilicus gendjnamensis* Stapf (1886) $\equiv$ *Cotyledon gendjnamensis* (Stapf) Parsa (1948); **incl.** *Rosularia radiculiflora* Borissova (1939) (*nom. inval.*, Art. 36.1).

[1] Caudex mostly well-developed, to 1.7 cm Ø, passing into 1 to several tapR; **Ros** flattish or semiglobular, 1.5 - 10 cm Ø; **L** oblong-linear to spatulate with rounded apex, 11 - 40 × 2 - 8 mm, dark green, glaucous or not, normally glabrous, margin esp. in the upper ½ conspicuously whitish-horny and serrulate to dentate; **Inf** lateral panicle thyrse, 3 - 20 cm, flowers in the apical ½ only, completely glabrous or upper parts glandular-hairy; **Fl** 5-merous, $\pm$ tubular to narrowly funnel-shaped, 6 - 11 mm, glabrous or outside glandular-hairy; **Pet** united for ½ - ⅔, pale to dark pink; **NSc** $\pm$ square; **Ca** slender; **Sty** distinctly offset.

This widespread ssp. is very variable, esp. in its degree of glandular-hairiness. – [U. Eggli]

R. sempervivum ssp. **pestalozzae** (Boissier) Eggli (Bradleya 6: Suppl.: 98, ill. (p. 99), 1988). **T** [lecto]: Turkey, Adana (*Balansa* 705 [G, BM, C, FR, G, JE, K]). – **D**: S Turkey, adjacent NW Syria; on limestone, 1000 - 2300 m.

$\equiv$ *Umbilicus pestalozzae* Boissier (1872) $\equiv$ *Rosularia sempervivum* var. *pestalozzae* (Boissier) Thiébaud (1940) $\equiv$ *Cotyledon pestalozzae* (Boissier) Bornmüller (1941) $\equiv$ *Rosularia pestalozzae* (Boissier) Samuelsson & Fröderström (1960).

[1] Differs from ssp. *glaucophylla*: **L** medium green, never glaucous, glandular-hairy and $\pm$ viscid; **Inf** glandular-hairy in the upper ½.

The two taxa ssp. *glaucophylla* and ssp. *pestalozzae* form a closely-related pair, differing from the remainder of the *R. sempervivum*-aggregate in their smallish flowers. – [U. Eggli]

R. sempervivum ssp. **sempervivum** – **D**: E and SE Turkey, C and N Iran, Armenia, Azerbaidzhan; 900 - 2500 m. **I**: Eggli (1988: 87).

Incl. *Rosularia rosae* Fedorov in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sedum racemosum* Pallas ex Ledebour (1843) (*nom. inval.*, Art. 34.1a); **incl.** *Sedum sempervivum* var. *genuinum* Hamet (1929) (*nom. inval.*, Art. 24.3).

[1] Caudex mostly well-developed, 0.6 - 1.5 cm Ø; **Ros** flattish, 2 - 6 cm Ø, solitary or offsetting; **L** oblong and truncate, or spatulate with rounded or

emarginate apex, dark vivid green, glossy or dull, 1.8 - 6 cm, young densely glandular-hairy and viscid, old subglabrous with glandular-hairy margin; **Inf** lateral panicle thyrse with up to 25 **Fl**, upper ½ or completely glandular-hairy and viscid, drooping in bud; **Fl** 5-merous, narrowly funnel-shaped, 0.8 - 1.1 cm, outside glandular-hairy; **Pet** united for ⅔ (rarely less to ½), pink with purplish-pink venation; **NSc** $\pm$ rectangular; **Ca** slender, pale greenish, gradually tapering into the **Sty**.

Intermediates with ssp. *persica* and ssp. *libanotica* are known. – [U. Eggli]

R. serrata (Linné) A. Berger (NPF2 18a: 465, 1930). **T**: LINN 594.4. – **D**: Greece (SE Aegean Islands), SW coastal Turkey, on limestone, to 800 m. **I**: Eggli (1988: 104). **Fig. XXXI.d**

$\equiv$ *Cotyledon serrata* Linné (1753) $\equiv$ *Umbilicus serratus* (Linné) De Candolle (1801); **incl.** *Sedum libanoticum* Strand ex Linné (1762) $\equiv$ *Orostachys libanotica* (Strand ex Linné) Fischer (1809) (*nom. inval.*, Art. 43.1) $\equiv$ *Rosularia libanotica* (Strand ex Linné) Samuelsson (1960) (*nom. inval.*, Art. 33.2); **incl.** *Cotyledon samium* D'Urville (1822) $\equiv$ *Umbilicus samius* (D'Urville) De Candolle (1828).

[1] Caudex lacking or to 8 mm Ø, sometimes with a long slender tapR; **Ros** $\pm$ flat or **L** $\pm$ erect, 1.5 - 6 cm Ø (rarely larger), solitary or offsetting and forming small clumps; **L** oblong-spatulate with rounded or somewhat triangular tip, 1 - 4 cm, conspicuously glaucous to bluish-pruinose or white-farinose, often tinged purplish under water stress, glabrous, margin whitish-horny, finely serrate to denticulate; **Inf** slender-pyramidal panicles or racemose thyrse, mostly lateral, basally leafy and when young mistaken for an offset, 8 - 25 cm, glabrous; **Fl** 5-merous, 6 - 8 mm, urceolate; **Pet** 5 - 7 mm, united for $\pm$ ½, whitish (Aegean Islands) or pale pink to rose-coloured (Turkey); **NSc** oblong-rectangular, to 0.8 mm; **Ca** slender or massive, tapering into the short **Sty**. – [U. Eggli]

×SEDADIA

U. Eggli

×**Sedadia** Moran (Baileya 19: 147, 1975).

$\equiv$ *Sedum* × *Villadia*. See Uhl (1994c) for a list of numerous known hybrid combinations. The only named combination is × *Sedadia amecamecana* for the combination *Sedum dendroideum* ssp. *monticola* × *Villadia batesii*, but since the latter is now classified as *Sedum goldmanii*, the proper name for this naturally occurring hybrid is again *Sedum* × *amecanum*.

SEDELLA

J. Thiede

Sedella Britton & Rose (Bull. New York Bot. Gard. 3(9): 45, 1903). **T:** *Sedum pumilum* Benth. – **Lit:** Clausen (1975); Denton (1993); Moran (1998a). **D:** USA (N and C California, Oregon?). **Etym:** Diminutive of *Sedum*; for the diminutive size of the plants.

Incl. *Parvisedum* Clausen (1946) (*nom. illeg.*, Art. 52.1). **T:** *Sedum pumilum* Benth. [Typification by inference with the type of the replaced name.].

Glabrous erect annuals, mostly branching; stems mostly < 10 cm, often red or reddish; **L** along the stems, opposite near the base, alternate above, sessile, oblong-ovoid to obovoid, obtuse to rounded, mostly deciduous before anthesis; **Inf** terminal cymes with 1 to several **Br**, cincinni almost circinate; **Fl** erect, 5-merous; **Ped** very short and **Fl** subsessile; **Sep** erect, almost free, all equal, deltoid, acute, not spurred; **Pet** imbricate in bud, erect to spreading, connate at the very base, bright to pale or greenish-yellow, often with reddish midrib, much longer than the **Sep**; **St** as many or 2× as many as **Sep**, inserted at the base of the **Pet**, included; **NSc** clavate to cuneate; **Ca** erect, clavate, with a single basal erect ovule; **Fr** flimsy, clavate, nutlet-like and indehiscent, whorled, each with 1 erect **Se**; **Se** oblong-clavate, 0.7 - 1.5 mm, longitudinally striate. – **Cytology:** $n = x = 9$.

Sedella, which was revised by Moran (1998a), is, apart from its small annual habit, esp. characterized by its carpels with only one single erect basal ovule each. The carpels remain indehiscent at maturity and form nutlet-like fruits which Moran (l.c.) calls 'utricles'.

The status of *Sedella* (either a separate genus or included in *Sedum*) was treated controversially by different authors. *Sedum* represents a large artificial paraphyletic hold-all genus encompassing the least specialised groups within tribe *Sedeeae*. Most authors agree that only the larger, morphologically more distinct lineages derived from within *Sedum* should be accepted as separate genera ('t Hart in Moran l.c. and pers. comm.). This would call for subsuming *Sedella* under *Sedum*, based on the minor morphological differences (Eggli & al. 1995). Here, *Sedella* is kept separate from *Sedum* for purely practical reasons, because the merger would result in nomenclatural problems and would necessitate new names.

Clausen (1946) renamed the genus as *Parvisedum* due to the earlier name *Sedella* Fourreau (1868) for European species of *Sedum*. Fourreau's name is, however, not validly published (Eggli 1992b) and *Parvisedum* thus represents a superfluous renaming of *Sedella*.

Sedella is an endemic of the Californian winter rainfall region, which is in general especially rich in annual endemics (Raven & Axelrod 1998). The

ecology of the species of *Sedella* is interesting and remarkable: They occur predominantly in thin soil covering flat rocks in and around the margins of vernal pools and in seasonally wet areas, where the seeds germinate in winter, and may form dense flowering mats in spring. These mats have already dried up again when the hot dry summers arrive (Moran 1998a). The continued existence of the species is imperiled by habitat loss and degradation (Anonymus 2000).

S. leiocarpa H. Sharsmith (Madroño 5: 192, figs. 1, 3, 4, 1940). **T:** USA, California (*Baker* 8971 [UC]). – **D:** USA (N California); dry vernal pools and clay flats, 500 - 700 m, flowering April to May. **I:** Moran (1998a).

≡ *Parvisedum leiocarpum* (H. Sharsmith) R. T. Clausen (1946).

[1] Annuals, 2 - 5 cm, simple or often with 1 - 3 simple ascending **Br**, stems with 2 - 5 nodes; **L** to 7 × 4 mm, to 1 mm thick; **Inf** with solitary cyme **Br** 1 - 2 cm long, with 2 - 10 **Fl**; **Fl** 3 - 4 mm Ø; **Cal** tapering to the **Ped**; **Pet** narrowly lanceolate, first strongly ascending, soon erect but separated, later appressed to the **Ca**, subacuminate, arcuate, 2.5 - 3.5 × 0.5 - 0.9 mm, yellowish becoming paler, closely red-lineolate except the margins; **St** 5; **Sty** erect, 0.2 - 0.4 mm; **Fr** ascending, 2 - 2.5 mm, with a ventral flange 0.2 mm wide; **Se** 1 - 1.3 mm.

This taxon grows in dense colonies but is local at only 2 localities and is therefore listed as rare and endangered in California (Moran 1998a). The extant populations of *S. leiocarpa* collectively cover a total area of less than 1.2 ha; all populations occur on private lands (Anonymus 2000).

S. pentandra H. Sharsmith (Madroño 3: 240, figs. 1, 4, 5, 1936). **T:** USA, California (*Sharsmith & Sharsmith* 1831 [UC]). – **D:** USA (N and C California); thin soil on slate, shale, sandstone or serpentine, 250 - 700 m, flowering March to May. **I:** Moran (1998a).

≡ *Parvisedum pentandrum* (H. Sharsmith) R. T. Clausen (1946).

[1] Annuals, 3 - 13 cm, simple below the **Inf** or with 1 - 4 ascending **Br** shorter than the main axis, stem with 5 - 15 nodes; **L** 4 - 7 × 2 - 3 mm, 1.5 - 2 mm thick; **Inf** with 1 - 5 cyme **Br** 1 - 4 cm long, with 1 - 12 **Fl**; **Fl** 2 - 3 mm Ø; **Cal** base thickened for 1 mm; **Pet** ovate-lanceolate, strongly ascending at anthesis, later appressed to the **Ca**, acute, 2.5 - 5 × 0.3 - 1.2 mm, pale greenish-yellow or with dorsal red streak; **St** 5; **Sty** erect, 0.2 - 0.4 mm; **Fr** erect, pressed together, 1.2 - 1.5 mm; **Se** 0.7 - 0.9 mm.

S. pumila (Benth.) Britton & Rose (Bull. New York Bot. Gard. 3(9): 45, 1903). **T:** USA, California (*Hartweg* 1735 [BM]). – **D:** USA (N and C California, Oregon?); gravelly soils, vernal pools, thin

soils on rock outcrops, 30 - 1500 m, flowering March to May or even June. **I:** Moran (1998a).

≡ *Sedum pumilum* Benth (1849) ≡ *Parvisedum pumilum* (Benth) R. T. Clausen (1946); **incl.** *Sedum congdonii* Eastwood (1898) ≡ *Sedella congdonii* (Eastwood) Britton & Rose (1903) ≡ *Sedella pumila* var. *congdonii* (Eastwood) Jepson (1925) ≡ *Sedum pumilum* var. *congdonii* (Eastwood) Fröderström (1936) ≡ *Parvisedum congdonii* (Eastwood) R. T. Clausen (1946).

[1] Annuals, 3 - 17 cm, commonly with several erect **Br** about equalling the main axis, or **Br** spreading, stems with 10 - 25 nodes; **L** 4 - 7 × 1 - 3 mm; **Inf** with 1 - 5 cyme **Br** 1 - 5 cm long, with 5 - 15 **Fl**; **Fl** 4 - 10 mm Ø, with musty scent; **Cal** tapering to the **Ped**; **Pet** elliptic to lanceolate, widely spreading, erect at **Fr** time, acute, 2.5 - 5 × 0.3 - 1.2 mm, straw-coloured to bright yellow, commonly marked red on the keel; **St** 10; **Sty** erect, or when short often recurved; **Fr** erect or ascending, 1.2 - 2.5 mm; **Se** 0.8 - 1.5 mm.

Sedella congdonii, kept as a separate species or variety by many authors, is included in the synonymy of *S. pumila* due to the many morphological intermediates and overlapping distribution ranges (Moran 1998a).

×SEDEVERIA

U. Eggli

×**Sedeveria** E. Walther (CSJA 25(1): 20-21, 1953). **T:** *Sedeveria hummellii* E. Walther.

= *Sedum* × *Echeveria*. A handfull of taxa and cultivars has been named.

SEDUM

H. 't Hart & B. Bleij

Sedum Linné (Spec. Pl. [ed. 1], 5, 1753). **T:** *Sedum acre* Linné [Lectotype, proposed by M. L. Green in Hitchcock, Prop. Brit. Bot., 156, 1929; and proposed for conservation by 't Hart in Jarvis in Taxon 41: 569, 1992.]. – **Lit:** Praeger (1921a); Fröderström (1930); Fröderström (1931); Fröderström (1932); Fröderström (1936a); Clausen (1959); Zardini (1971); Clausen (1975); Evans (1983); Fu & Fu (1984: 72-159); Stephenson (1994); Jalas & al. (1999: 77-123 [distribution maps]); Ohba (2001); Fu & Ohba (2001). **D:** Mainly temperate and subtropical regions of N America, Asia, Europe, N Africa and the Near East, less frequently also in S America and C-E Africa. **Etym:** Lat. 'sedum', Houseleek, Stonecrop, i.e. the Latin vernacular name of several *Crassulaceae*, with unresolved origin.

Incl. *Enchylus* Erhart (1789) (*nom. inval.*, Art. 32.1c). **T:** *Sedum annuum* Linné [Typification by inference, only element included.].

Incl. *Diamorpha* Nuttall (1818) (*nom. illeg.*, Art. 53.1). **T:** *Sedum pusillum* Michaux [= *Diamorpha smallii* Britton.].

Incl. *Chetyson* Rafinesque (1821). **T:** *Chetyson sagittatum* Rafinesque [Typification according to ING.].

Incl. *Aithales* Webb & Berthelot (1840). **T:** *Sedum rubens* Linné [Lectotype, according to 't Hart, Fl. Medit. 1: 52, 1991.].

Incl. *Telmisa* Fenzl (1842). **T:** *Telmisa sedoides* Fenzl [Typification according to ING.].

Incl. *Procrassula* Grisebach (1843). **T:** *Crassula caespitosa* Cavanilles [= *Procrassula magnolii* Grisebach *nom. illeg.* Typification according to ING.].

Incl. *Leucosedum* Fourreau (1868) (*nom. inval.*, Art. 32.1). **T:** *Sedum album* Linné [Lectotype, designated by H. Ohba, J. Fac. Sci. Univ. Tokyo, Bot. 12(4): 176, 1978.].

Incl. *Sedella* Fourreau (1868) (*nom. inval.*, Art. 32.1). **T:** *Sedum atratum* Linné [Lectotype, according to 't Hart, Fl. Medit. 1: 52, 1991.].

Incl. *Macrosepalum* Regel & Schmalhausen (1882). **T:** *Macrosepalum turkestanicum* Regel & Schmalhausen.

Incl. *Altamiranoa* Rose (1903). **T:** *Cotyledon batesii* Hemsley.

Incl. *Gormaniana* Britton (1903). **T:** *Cotyledon oregonensis* S. Watson [= *Gormaniana watsonii* N. L. Britton, *nom. illeg.*].

Incl. *Tetrorum* Rose (1903). **T:** *Sedum pusillum* Michaux.

Incl. *Corynephyllum* Rose (1905). **T:** *Corynephyllum viride* Rose.

Incl. *Sempervivella* Stapf (1923). **T:** *Sempervivum album* Edgeworth [Typification by inference, only element included.].

Incl. *Congdonia* Jepson (1925) (*nom. illeg.*, Art. 53.1). **T:** *Sedum pinetorum* Brandegee.

Incl. *Monanthella* A. Berger (1930) (*nom. inval.*, Art. 34.1). **T:** *Sedum jaccardianum* Maire & Wilczek.

Incl. *Oreosedum* Grulich (1984). **T:** *Sedum album* Linné.

Incl. *Petrosedum* Grulich (1984). **T:** *Sedum reflexum* Linné.

Incl. *Poenosedum* Holub (1984). **T:** *Sedum tuberosum* Cosson & Letourneaux.

Incl. *Amerosedum* A. Löve & D. Löve (1985). **T:** *Sedum lanceolatum* Torrey.

Incl. *Breitungia* A. Löve & D. Löve (1985). **T:** *Sedum oreganum* Nuttall.

Incl. *Clausenellia* A. Löve & D. Löve (1985). **T:** *Sedum ternatum* Michaux.

Incl. *Cockerellia* (Clausen & Uhl) A. Löve & D. Löve (1985). **T:** *Sedum cockerellii* Britton.

Incl. *Etiosedum* A. Löve & D. Löve (1985). **T:** *Sedum annuum* Linné.

Incl. *Hjaltalinia* A. Löve & D. Löve (1985). **T:** *Sedum villosum* Linné.

Incl. *Helladia* M. Král (1987). **T:** *Sedum creticum* C. Presl.

Incl. *Balfouria* (H. Ohba) H. Ohba (1995) (*nom. illeg.*, Art. 53.1). **T:** *Sedum balfourii* Hamet.

Incl. *Ohbaea* Byalt & I. V. Sokolova (1999). **T:** *Sedum balfourii* Hamet.

Glabrous or pubescent, perennial or annual herbs with erect, ascending, procumbent or creeping, often rooting, usually much branched non-flowering shoots, rarely rosulate or forming dense **Ros**; **R** usually fibrous, rarely tuberous or as tap**R**; stems usually hardly secondarily thickened, sometimes slightly woody at the base, rarely distinctly woody and conspicuously thickened or as subterranean caudex (= **Rstock**); **L** alternate, sometimes opposite or in whorls of 3 or 4, sessile or rarely semipetiolate or petiolate, succulent and usually terete or semi- or subterete, rarely flat, with a single abaxial apical hydathode and entire margins; flowering **Br** terminal or rarely axillary, usually erect or ascending; **Inf** often many-flowered cymes, corymbs, or compound **Inf** consisting of many cincinni, less often simple few-flowered cymes or corymbs; **Bra** usually present, 1 or 2 per **Fl**, often **L**-like; **Fl** usually 5-merous, rarely 3- or 4-merous or 6- to 12-merous, generally obdiplostemonous but sometimes haplostemonous, sessile or pedicellate; **Sep** green, broadly sessile or free and spurred, equal or strongly unequal, usually smaller than the **Pet**; **Pet** yellow, white, pink, purple or reddish, generally free or basally slightly connate, sometimes connate for $\frac{1}{3}$ or $\frac{2}{3}$, usually spreading during anthesis but sometimes erect, often with a distinct frequently reddish keel and a dorsal subapical appendage, usually with entire margins; **Fil** generally concolorous with the **Pet** and glabrous, sometimes basally papillate, generally free, though the epipetalous **St** often basally connate with the **Pet**, rarely fused with the **Pet** for a considerable length, shorter than the **Pet**; **Anth** globose or oblong, yellow to red or dark purple, sometimes whitish or pinkish; **NSc** oblong, square, transversely oblong, cuneate or spatulate, generally whitish, sometimes yellow or red; **Ca** usually sessile with a broad base and slightly connate at the base, less frequently completely free, rarely stipitate; **Sty** often ± 1 mm, slender and recurved during anthesis, less frequently short and **Sti** $\pm$ sessile; **Fr** erect, suberect or stellate-patent without lips along the ventral suture or stellate-patent with distinct lips bordering the ventral suture; **Se** usually ± 1 mm, ovoid to ellipsoid, testa costate, bipapillate, reticulate or reticulate-papillose. – *Cytology*: $2n = 4$ to ± 640 .

Sedum comprises ± 420 species and is thus by far the largest genus within the family. *Sedum* is mainly distributed in the subtropical and temperate zones of the N Hemisphere, though a few species occur in C-E Africa and S America. Species richness is highest on the American continent where ± 170 species occur, i.e. ± 30 species in Canada and the USA, ± 120 species in Mexico, and ± 20 species

in C and S America. Asia is second in species richness, with 130 - 140 species, whereas the Eurasian region (Europe, Near East, N and C-E Africa, and the Atlantic Islands) is third with ± 100 species. The *Sedum* floras of the 3 continents are endemic to each continent, except for 2 Eurasian species, i.e. *S. villosum*, which has reached N America (Clausen 1975) and *S. aetnense*, which is also reported from the Tien-Shan in W China (Fröderström 1932), though this report is not confirmed in recent literature.

Ideally, *Sedum* comprises the herbaceous, predominantly perennial *Crassulaceae* with alternate and entire leaves with a single abaxial subapical hydathode, and 5-merous, obdiplostemonous flowers with free petals. However, quite a few *Sedum* species differ in 1 or 2 (rarely more) characters from this description. These are often distinctly woody, or have decussate or verticillate leaf arrangements, or 3- to 4- or 6- to 12-merous flowers, or they are distinctly sympetalous. Moreover, entire leaves with a single abaxial subapical hydathode occur in several other genera of the family. However, most *Sedum* species that do not fully agree with the idealized genus description appear to represent specialized forms within lineages that unmistakably belong to *Sedum*. Although there is a kind of general consensus about the classification of the bulk of the species that belong to *Sedum*, there is still much controversy about the proper delimitation of the genus ('t Hart & Eggli 1995: introduction).

The results of phylogenetic analyses of chloroplast DNA variation led to 3 systematically significant conclusions with respect to the delimitation and classification of the genus (see Ham (1994), 't Hart (1995), and Ham & 't Hart (1998)):

1. The flat-leaved Asian *Sedoideae* ('t Hart 1984) are sister taxa to *Sedum*. This former group corresponds with the "Telephium clade" of Ham (1994) and subtribe *Telephinae* 't Hart, and comprises the genera *Hylotelephium*, *Orostachys*, *Phedimus*, *Pseudosedum*, *Rhodiola* and *Umbilicus* ('t Hart 1995). The Asian genera *Meterostachys* and *Sinocrassula* also belong to the "Telephium clade" ('t Hart & Kim, pers. comm.). Furthermore, the monotypic Madagascan or African genera *Perrierosedum* and *Hypagophytum* were tentatively attributed to this lineage ('t Hart 1995).

2. The molecular analyses have proved beyond any doubt that the genus *Sedum* is paraphyletic. It is the stem-group within the *Sedum* lineage (subtribe *Sedinae*), which includes more than $\frac{1}{2}$ of the species of *Crassulaceae*. In addition to *Sedum*, this lineage comprises ± 360 species that are generally classified in ± 16 different (segregate) genera. These taxa are native to the Americas and Eurasia and represent relatively young so-called crown-groups, which evolved from different lineages within *Sedum*. Like *Sedum* these genera all have alternate entire leaves with a single abaxial subapical hyda-

thode. A majority of these genera is rosulate. Some have polymorous or sympetalous flowers.

3. Within *Sedum*, a strongly supported monophyletic clade, the "Acre clade" (see Ham (1994) and Ham & 't Hart (1998)), was observed, which comprises the *Sedum* species (and several segregate genera) with reticulate or reticulate-papillose seeds (see 't Hart & Berendsen (1980) and Knapp (1994)). Although these species are sometimes pubescent, they have no glandular hairs. Moreover, many *Sedum* species of this clade have unequal, basally free and spurred sepals ('t Hart & Koek-Noorman 1989). The stem groups of the *Sedum* lineage, on the other hand, have costate seeds, broadly sessile (not spurred), usually basally fused sepals, and are often glandular-pubescent. The *Sedum* stem-group species have been classified in *Sedum* subgenus *Gormaniana*, the species of the "Acre clade" in subgenus *Sedum* ('t Hart 1995). Both subgenera spread independently to the 3 continents of the Northern Hemisphere, but the resulting 6 lineages evolved in markedly different ways.

The diagnostic descriptions of the 2 subgenera is as follows:

- [1] Subgen. *Sedum*: Usually glabrous or rarely with non-glandular **Ha**; **Sep** basally free and spurred or broadly sessile, often distinctly unequal; **Se** testa reticulate or reticulate-papillose.

Subgen. *Sedum* comprises ± 320 species. There are ± 170 species in America, which are confined to Mexico and C and S America, except for 2 species which occur in the S USA. The American species belong to a large monophyletic lineage, which, in addition to *Sedum*, contains another ± 185 species, which are presently classified in 7 segregate genera (*Cremnophila*, *Echeveria*, *Graptopetalum*, *Lenophyllum*, *Pachyphytum*, *Sedum* and *Villadia*). They are collectively referred to as the "Mexican *Sedinae*" ('t Hart 1999b). In Eurasia, subgen. *Sedum* comprises ± 30 species and in Asia ± 120 species. Although subgen. *Sedum* contains some quite distinct infrageneric groups in Asia as well as in Eurasia, no generally accepted segregate genera have ever been distinguished within these lineages.

- [2] Subgen. *Gormaniana* (Britton) Clausen 1942: Often glandular-pubescent; **Sep** broadly sessile, usually of equal length; **Se** testa costate or bipapillate.

Subgen. *Gormaniana* comprises ± 110 species. In America, there are ± 28 species, which are all confined to the USA and Canada. The genera *Dudleya* and *Sedella* evolved from this lineage. In Eurasia, the subgenus comprises ± 70 species, which occur throughout the area. The genera *Aeonium*, *Aichryson*, *Monanthes*, *Afrovivella*, *Pistorinia*, *Prometheum*, *Rosularia* and *Semprevivum*, which comprise a total of ± 125 species, evolved from this *Sedum* lineage. In Asia, Sub-

gen. *Gormaniana* comprises probably ± 10 species, though this number is somewhat uncertain due to our incomplete knowledge of the character states of the sepals and ornamentation of the seeds of many species. Some rosulate Himalayan taxa have been included in *Rosularia* by Eggli (1988) and 't Hart & al. (1999).

Many of the old *Sedum* names have not been studied properly, and in view of our incomplete knowledge of the variation presented by the more widely distributed taxa, the synonymizations as given in the following accounts are sometimes tentative only. *S. lahovaryanum* Hamet 1913 and *S. longuetiae* Hamet 1913, both described from Mexico, are probably not members of this genus. Fröderström (1936a) placed them with a questionmark in *Echeveria*, but the measurements given in the protologue (flowers 6.5 cm long or more) is incongruous.

No attempt was made to trace and interpret the majority of garden names such as those listed by Praeger (1914). Even in modern horticultural literature, such names without any botanical foundation are still occasionally used.

Editorial Note: Henk 't Hart unexpectedly died in July 2000 after a protracted illness, before he could complete the synopsis of the genus *Sedum* for this Lexicon. The missing taxa were therefore compiled by the editor and are based on the protologues and/or floristic studies. Their assignment to one of the 2 subgenera is in many cases tentative only, and the readers are asked for their understanding for the inhomogeneous coverage of the genus. Joachim Thiede (University of Hamburg) and Vyacheslav Byalt (Komarov-Herbarium, Moscow) are thanked for their help. They contributed texts for several taxa. In addition, the recent treatments of the genus for the Flora of Japan (Ohba 2001) and the Flora of China (Fu & Ohba 2001) were also incorporated into the present synopsis.

The following names are of unresolved application but are referred to this genus: *Altamiranoa montana* Rose in sched. ex Fröderström (1936) (*nom. inval.*, Art. 34.1a); *Anacampseros borderi* Jordan & Fourreau (s.a.) $\equiv$ *Hylotelephium borderi* (Jordan & Fourreau) Holub (1984); *Crassula verticillaris* Linné (1770); *Graptopetalum goldii* Matuda (1956) $\equiv$ *Sedum* cv. *Goldii* (Matuda) R. Evans (1987) $\equiv$ *Sedum goldii* (Matuda) hort. (1999) (*nom. inval.*, Art. 29.1); *Sedum acre* var. *degenianum* Domin (s.a.); *Sedum arboreum* (Linné) Palau (1788); *Sedum azureum* Wirtgen ex F. Schultz (1852) (*nom. illeg.*, Art. 53.1); *Sedum bergeri* Fournier (s.a.); *Sedum cavei* Hamet ex W. W. Smith & Cave (1911) (*nom. inval.*, Art. 32.1c); *Sedum chiisanense* Nakai (1915) (*nom. inval.*, Art. 32.1c?); *Sedum confertum* Delile (1812); *Sedum cooperi* hort. ex Clémenceau (1868); *Sedum derbezii* Petit-mengin (s.a.); *Sedum engadinense* Brügger (s.a.);

Sedum erraticum Brügger (s.a.); *Sedum fuereri* Wein (1921); *Sedum groenlandicum* hort. (s.a.) (*nom. inval.*, Art. 29.1?); *Sedum hercegnovi* Wiesbaur (s.a.) = *Sedum sexangulare* ssp. *hercegnovi* (Wiesbaur) J. A. Huber (1936); *Sedum lividum* hort. (1877) (*nom. illeg.*, Art. 53.1); *Sedum majus* Masters (s.a.) (*nom. inval.*, Art. ?); *Sedum meehanii* Gray (1880); *Sedum minus* Haworth (1825); *Sedum nipponicum* hort. (1938) (*nom. inval.*, Art. 36.1); *Sedum xpatrickii* hort. (s.a.) (*nom. inval.*, Art. 29.1?); *Sedum peruvianum* Gray (1854); *Sedum polystriatum* R. T. Clausen (1946); *Sedum pulchellum* Aznavour (1917); *Sedum punctatum* Kitaibel (1863); *Sedum quevai* W. W. Smith & Cave (1913) (*nom. inval.*, Art. 32.1c); *Sedum rubromucronatum* Hort. R. L. Evans (s.a.) (*nom. inval.*, Art. 29.1); *Sedum rupestre* fa. *purpureum* Wilczek ex Maire (1977) (*nom. inval.*, Art. 36.1, 37.1); *Sedum sedifolium* hort. (s.a.) (*nom. inval.*, Art. 29.1 / 61.1); *Sedum septangulare* Haworth (1812); *Sedum stramineum* Paulsen (1922); *Sedum violaceum* Vahl (s.a.); *Sedum virens* Aiton (1789); *Sedum viridulum* Haworth (1827).

S. 'Spiral Staircase' R. Stephenson (Brit. Cact. Succ. J. 11(2): 60-62, ill., 1993).

Frequently encountered in cultivation under the incorrectly applied name *Villadia batesii*. The origin of the cultivar, which might be a hybrid, is unresolved. – [U. Eggli]

S. abchasicum Kolakovsky ex Byalt (Novosti Sist. Vyssh. Rast. 31: 123-126, ill., 1998). **T:** Russia, Adygea (*Portenier* s.n. [LE, ZSS]). – **D:** NW Caucasus (Russia: Adygea); limestone rocks, 1500 - 2200 m.

[1] Perennial herbs, tuft-forming with creeping branched rhizomes; **Br** 2 - 8 cm, prostrate; **L** alternate, slightly imbricate, 1.5 - 3 (-5) × 0.5 - 1.75 mm, elliptic-oblong to oblong-ovate, obtuse or subacute, shortly spurred, upper **L** yellowish-green, lower **L** flushed with red; flowering **Br** erect, simple, to 15 cm; **Inf** corymbiform, lax, with 3 - 6 (-10) **Fl** in 2 - 3 cincinni; **Ped** to 0.75 mm or **Fl** sessile; **Fl** 5-merous, small; **Pet** 3.5 - 5 mm, sulphur-yellow, ovate-lanceolate, acute; **St** slightly shorter than the **Pet**; **NSc** obovate, emarginate; **Fr** somewhat spreading but **Ca** basally connate for 0.6 - 0.8 mm; **Se** oblong, brown, papillose.

Close to *S. acre* but differing by the more richly branched stems, longer leaves and some minor flower characters. – [U. Eggli]

S. acre Linné (Spec. Pl. [ed. 1], 432, 1753). **T:** BM [lecto: Herb. Clifford 177, *Sedum* 5]. – **Lit:** Jalas & al. (1999: 82-83). **D:** Almost throughout the whole of Europe as well as in N Africa and Turkey (N Anatolia); from sea-level to ± 2500 m.

= *Sedum sexangulare* var. *acre* (Linné) F. & P. (1898); **incl.** *Sedum acre* var. *sopiana* (Prisster)

Soó (s.a.); **incl.** *Sedum procumbens* Schrank (1789); **incl.** *Sedum glaciale* Clarion (1805) = *Sedum acre* ssp. *glaciale* (Clarion) Duby (s.a.); **incl.** *Sedum neglectum* Tenore (1831) = *Sedum acre* ssp. *neglectum* (Tenore) Arcangeli (1882) = *Sedum acre* var. *neglectum* (Tenore) Sampaio (1947); **incl.** *Sedum acre* var. *genuinum* Godron (1848) (*nom. inval.*, Art. 24.3); **incl.** *Sedum acre* var. *aureum* Masters (1878); **incl.** *Sedum acre* var. *majus* Masters (1878) = *Sedum acre* ssp. *majus* (Masters) R. T. Clausen (1975); **incl.** *Sedum acre* fa. *pentagonum* Pacher (1887); **incl.** *Sedum acre* var. *morbifugum* Chabert (1889); **incl.** *Sedum acre* fa. *typicum* Beck (1892) (*nom. inval.*, Art. 24.3); **incl.** *Sedum erectum* Freyn (1895); **incl.** *Sedum wettsteinii* Freyn (1900) = *Sedum acre* ssp. *wettsteinii* (Freyn) O. Schwarz (s.a.) = *Sedum acre* var. *wettsteinii* (Freyn) Hegi & Em. Schmidt (1922); **incl.** *Sedum acre* var. *robustum* Velenovsky (1902) = *Sedum robustum* (Velenovsky) Domin (1930) (*nom. illeg.*, Art. 53.1) = *Sedum acre* ssp. *robustum* (Velenovsky) J. A. Huber (1936); **incl.** *Sedum acre* fa. *umbrosum* Schubert (1904); **incl.** *Sedum acre* var. *atlanticum* Battandier (1905); **incl.** *Sedum drucei* Graebner (1913) = *Sedum acre* ssp. *drucei* (Graebner) J. A. Huber (1936) (*nom. inval.*, Art. 33.2, 34.1a); **incl.** *Sedum minimum* Nieuwland (1915) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum maweanum* hort. ex Praeger (1921) (*nom. inval.*, Art. 29.1); **incl.** *Sedum acre* fa. *fastigiatum* Beck (1922); **incl.** *Sedum acre* fa. *grandiflorum* Beck (1922); **incl.** *Sedum acre* fa. *imbricatum* Beck (1922); **incl.** *Sedum krajinae* Domin (1929) = *Sedum acre* var. *krajinae* (Domin) Jávorka (1924) = *Sedum acre* ssp. *krajinae* (Domin) J. A. Huber (1936); **incl.** *Sedum rohlena* Domin (1929) = *Sedum acre* var. *rohlena* (Domin) Domin (s.a.) = *Sedum acre* ssp. *rohlena* (Domin) J. A. Huber (1936); **incl.** *Sedum zlatiborense* Domin (1929) = *Sedum acre* var. *zlatiborense* (Domin) Domin (s.a.) = *Sedum robustum* var. *zlatiborense* (Domin) Domin (s.a.) (*incorrect name*, Art. 11.4); **incl.** *Sedum acre* fa. *confertum* Domin (1930); **incl.** *Sedum acre* var. *normanii* Fröderström (1932); **incl.** *Sedum acre* ssp. *euacre* Dostal (1948) (*nom. inval.*, Art. 26.2); **incl.** *Sedum acre* fa. *acutifolium* Stefanoff (1950); **incl.** *Sedum acre* fa. *microphyllum* Stefanoff (1950) = *Sedum acre* ssp. *microphyllum* (Stefanoff) Bertová (1982); **incl.** *Sedum sexangulare* fa. *elatum* Prisster (1960); **incl.** *Sedum neglectum* ssp. *sopiana* (Prisster) (1963); **incl.** *Sedum acre* fa. *ramosum* Prisster (1963) (*nom. inval.*, Art. 37.1); **incl.** *Sedum acre* var. *almadii* Prisster (1966).

[1] Perennial herbs, tufted or forming mats of intertwined laxly branched trailing and rooting non-flowering shoots ascending at the tips; **L** alternate, densely imbricate, sessile with a short obtuse spur, usually triangular-ovoid (rarely subconical), obtuse, terete to semiterete (elliptic in cross-section), usually deciduous (if persistent then white, soft and papery), (2-) 5 (-8) mm; flowering **Br** erect, usually

simple, 5 - 10 (-15) cm; **Inf** cymes with (1-) 2 (-3), rarely forked, monochasial **Br**; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile or subsessile; **Sep** basally free, spurred, unequal, oblong-ovoid, obtuse, to ± 3 mm; **Pet** free, oblong-ovoid to lanceolate, acute to acuminate, bright yellow, 5 - 9 mm; **Fil** yellow; **Anth** oblong, yellow; **Sty** long and slender; **NSc** square; **Fr** stellately patent, yellowish, with distinct pale lips along the ventral sutures; **Se** oblong-ovoid, yellowish- to reddish-brown, reticulate or reticulate-papillose. – *Cytology*: $2n = 40, 60, 80, 100, 120$.

Very variable in size, leaf shape, and size of inflorescences and flowers. Many local populations have been given specific or subspecific rank, but their supposedly diagnostic features can usually be matched in regions very remote from those from which they were described. Most of the plants from the Mediterranean region have longer, more acute leaves, and larger inflorescences and flowers than the plants of N Europe, and have been distinguished as ssp. *neglectum*. Although the Mediterranean plants are predominantly diploid ($2n = 40$) and the N plants tetraploid ($2n = 80$), the 2 taxa are connected by a large series of morphologically and cytologically intermediate forms, in particular in S-C Europe. *S. acre* belongs to the comparium of Ser. *Acria* A. Berger ('t Hart 1991). – [H. 't Hart]

S. acropetalum Fröderström (Acta Horti Gothob. 10(Appendix): 35-36, ills., 1936). **T** [syn]: Mexico, San Luis Potosí (*Purpus* 5593 [UC]). – **D**: Mexico (San Luis Potosí).

[1] Glabrous erect perennial subshrubs 30 - 40 cm tall, branched above, sterile **Br** arising from middle **L** axils, densely leafy at the tips; **L** alternate, suboblong, 10 - 12 mm, subacute, broadly spurred; **Inf** paniculate with slender peduncle; **Fl** 5-merous, sessile; **Sep** broadly sessile, ± 3 mm, equal, lanceolate, aristate-acute; **Pet** basally connate, lanceolate-aristate, with a narrow **Sp**-like mucro, whitish; **NSc** subquadrate, obtuse, yellowish; **Fr** subdivergent; **Se** subovoid, reticulate-papillose.

Related to *S. calcicola* and *S. lenophylloides*.

S. actinocarpum Yamamoto (Suppl. Icon. Pl. Formos. 2: 17, 1926). **T**: Taiwan [Formosa], Prov. Taihoku (*Hayata* s.n. [TI]). – **D**: Taiwan; mountains, 300 - 2500 m. **I**: Tang & Huang (1989: 161); Tang & Huang (1993: 18).

[1] Glabrous annual herbs with erect, simple or di- (tri-) -chotomously forked stems; **L** alternate, occasionally opposite, spatulate, $8 - 27 \times 4 - 11$ mm, rounded or obtuse; flowering **Br** erect; **Inf** cymose; **Fl** 5-merous, sessile; **Sep** basally free, unequal, spatulate or oblanceolate or linear-oblanceolate, base cuneate, $2.4 - 4.5 \times 2 - 3$ mm wide, subdivergent; **Pet** elongate-oblong or lanceolate, acuminate, somewhat cuneate at the base, 4×1.5 mm, yellow; **NSc** rectangular to almost square; **Fr** stellately patent; **Se** very small, elongate-oblong.

S. adolphi Hamet (Notizbl. Königl. Bot. Gart. Berlin 5(49): 277-278, 1912). **T**: Mexico (*Purpus* s.n. [not preserved ?]). – **D**: Mexico (Veracruz). **I**: Fröderström (1936a: 25, t. 13).

[1] Glabrous perennial subshrubs with much branched spreading, sprawling or ascending stems, 10 - 30 cm; **L** imbricate, alternate, broadly lanceolate to obovate, 12 - 30 mm, acute to subacute, spurred, obscurely carinate, subterete, very fleshy; **Inf** corymbose; **Ped** 6 - 10 mm; **Fl** 5-merous; **Sep** broadly sessile, triangular-semiorbicular, apiculate, $\pm 1.5 \times 1$ mm; **Pet** basally connate, oblong, tapering above, subobtusate, narrowly mucronate, white, ± 7.5 mm; **NSc** conspicuous, spatulate-square, deeply emarginate, ± 1 mm, pale yellow. – *Cytology*: $2n = 128$.

Very closely related to *S. nussbaumerianum*. Further studies may show that the 2 taxa are identical.

S. aetnense Tineo (in Gussone, Fl. Sicul. Syn. 2: 826, 1845). **T**: Italy, Sicily (*Tineo* s.n. [?, KFTA]). – **Lit**: Jalas & al. (1999: 84, distribution map). **D**: S Europe, Turkey (Anatolia), Iran, Near East, also recently cited from Spain and Serbia; usually very local. **I**: Sedum Soc. Newslett. No. 55: figs. 56-57, 2000.

$\equiv$ *Macrosepalum aetnense* (Tineo) Palanov (1988); **incl.** *Sedum tetramerum* Trautvetter (1880) $\equiv$ *Sedum aetnense* ssp. *tetramerum* (Trautvetter) Hamet (1914) $\equiv$ *Sedum aetnense* var. *tetramerum* (Trautvetter) Hamet (1914) $\equiv$ *Macrosepalum tetramerum* (Trautvetter) Palanov (1988); **incl.** *Macrosepalum turkestanicum* Regel & Schmalhausen (1882) $\equiv$ *Sedum turkestanicum* (Regel & Schmalhausen) Hamet ex B. Fedtschenko (1915); **incl.** *Sedum skorpilii* Velenovsky (1899); **incl.** *Sedum korpilii* Velenovsky (1899) (*nom. inval.*, Art. 61.1); **incl.** *Sedum albanicum* Beck (1904); **incl.** *Sedum erythrocarpum* Pau (1906); **incl.** *Sedum aetnense* var. *genuinum* Hamet (1914) (*nom. inval.*, Art. 24.3); **incl.** *Sedum ekimianum* Metzger & Duman (1990).

[1] Short-lived small glabrous annual herbs with erect or ascending usually simple **Br** to 6 cm tall; **L** alternate, imbricate and erect-appressed, sessile with a scarious basal spur, conical-oblong, 3 - 5 mm, subacute, terete or semiterete, often with ciliate or denticulate margins, glaucous or dark green; **Inf** cymose, usually consisting of 1 cincinnus (large specimens often with 2 or more cinnini); **Bra** 2, L-like, large; **Fl** 4- (or 5-) merous, autogamous, sessile, with 4 or 5 **St**; **Sep** basally free and spurred, strongly unequal, to 4 mm, acute, semiterete, often with ciliate margins; **Pet** free, oblong, 2 - 3 mm, subacute, white, sometimes tinged red; **Fil** white; **Anth** small, yellowish or red; **Sty** very short; **Fr** suberect, dark reddish-brown; **Se** small, ovoid, dark brown to blackish, reticulate. – *Cytology*: $2n = 26, 52$.

Belonging to the monotypic Ser. *Macrosepala* (Regel & Schmalhausen) Borissova. It was recently

also cited for several provinces of Spain (Ríos Ruiz & al. 1993: 166) and for Serbia (Zlatkovic & Randjelovic 1996). Fröderström (1932) reported its occurrence in W China (Tien-Shan), but this is not confirmed by recent Chinese floras. – [H. 't Hart]

S. alamosanum S. Watson (Proc. Amer. Acad. Arts 1880: 25, 1880). **T:** Mexico, Sonora (*Palmer* 373 [BM]). – **D:** Mexico (Sonora: Alamos Mts.). **I:** Fröderström (1936a: 43, t. 26). **Fig. XXXII.b**

[1] Perennial herbs with much branched **R**stock and numerous small sterile or floriferous tufted stems 6 - 10 cm tall; **L** alternate, linear-oblong to ovate, 3.5 - 5 mm, obtuse to acute, broadly spurred, papillate above, sometimes pubescent, terete, thick; **Inf** small, few-flowered corymbs; **Bra** ovate, mamillate; **Fl** 5-merous, long-pedicellate; **Sep** basally free, broadly spurred, ovate, obtuse, $\pm 2.5 \times 1.5$ mm, suberect; **Pet** basally free, subovate, broad and abruptly narrowing towards the tip, subacute, whitish, ± 5 mm, suberect; **NSc** subspatulate, slightly emarginate, reddish; **Se** reticulate. – *Cytology*: $2n = 36, 35, 72, 108$.

S. albertii Regel (Trudy Imp. S.-Peterburgsk. Bot. Sada 6(2): 299, 1879). **T:** Central Asia (*Regel* s.n. [LE]). – **D:** W Siberia (Kokchetav, Pavlodar and Karkaralinsk Mts., S Altai), C Asia: Ulutau Mts., Dzhungarian Alatau and Tien Shan Mts. to Tibet and W Mongolia (Mongolian Altai); stony mountain slopes, rocks, dry stony riverbeds, 1100 - 1750 m. **I:** Fröderström (1932: 22, pl. 11, as *Sedum schrenkii*).

Incl. *Umbilicus affinis* Schrenk (1841) $\equiv$ *Cotyledon affinis* (Schrenk) Maximowicz (1883) $\equiv$ *Sedum affine* (Schrenk) Hamet (1929) (*nom. illeg.*, Art. 53.1) $\equiv$ *Pseudosedum affine* (Schrenk) A. Berger (1930); **incl.** *Sedum schrenkii* Fröderström (1932); **incl.** *Sedum berunii* Prato (1974).

[1] Perennial herbs; rhizome robust, branching, caespitose, with numerous small sterile stems, 1 - 2 cm long; **L** linear to suboblong, 2 - 7 mm, densely mamillate; flowering **Br** several, loosely leafy, 7 - 15 (-25) cm; **Inf** corymbiform, with scorpioid second **Br**; **Ped** to 1 mm; **Fl** 5-merous; **Sep** very slightly connate, subacute, to 2.5 mm; **Cl** tube to 1.3 mm, lobes submucronate, to 5 - 6 mm, pure white; **Anth** dark purple; **NSc** denticulate; **Fr** oblong-ovoid, 3 - 3.5 mm; **Se** oblong-ovoid, to 1 mm.

A typical *Sedum*. The closest relationship is with the Caucasian *S. subulatum*.

S. berunii allegedly differs from *S. albertii* only in having yellow flowers, which might be an artefact of the type specimen. – [V. V. Byalt]

S. albomarginatum R. T. Clausen (*Sedum* North Amer., 424-425, ill., 1975). **T:** USA, California (*Clausen* 63169 [CU]). – **D:** USA (California: Sierra Nevada, Feather River canyon); 360 - 860 m.

[2] Perennial herbs with short branched **R**stocks with dense and compact **Ros** and axillary offsets; **L** alternate, oblanceolate, oblanceolate-oblong or spatulate, (14-) 28 (-67) $\times$ (5-) 11 (-18) mm, broadly rounded or truncate, sometimes emarginate, somewhat erose at the white margins, stiff, glaucous; flowering **Br** erect, 16 - 25 cm; **Inf** elongated, much branched cymes; **Ped** ± 0.8 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, lanceolate, acute or subacute, sometimes minutely papillose-ciliate, glabrous, green or slightly glaucous, $\pm 4.5 \times 2.5$ mm, erect; **Pet** basally connate, imbricate, oblanceolate-oblong, acute or obtuse, slightly mucronate, with the upper margins erose, yellow, ± 9.5 mm, erect at the base, then slightly divergent upwards; **Fil** pale green; **Anth** yellow; **NSc** transversely oblong, thickened, concavely truncate, white; **Se** pear-shaped, brown, costate. – *Cytology*: $2n = 30$.

S. album Linné (Spec. Pl. [ed. 1], 432, 1753). **T:** BM [Herb. Clifford 177, *Sedum* 6]. – **Lit:** Jalas & al. (1999: 96-97). **D:** Europe (except for parts of the N and E).

$\equiv$ *Leucosedum album* (Linné) Fourreau (1868) (*nom. inval.*, Art. 43.1) $\equiv$ *Oreosedum album* (Linné) Grulich (1984); **incl.** *Sedum albellum* Besse (s.a.); **incl.** *Sedum balticum* Hartman (s.a.) $\equiv$ *Sedum album* ssp. *balticum* (Hartman) J. A. Huber (1936); **incl.** *Sedum rhodopaeum* Podpera (s.a.) $\equiv$ *Sedum album* ssp. *rhodopaeum* (Podpera) J. A. Huber (1936); **incl.** *Sedum curtispetalum* Pau (s.a.) (*nom. inval.*, Art. 36.1); **incl.** *Sedum teretifolium* Lamarck (1779) $\equiv$ *Sedum album* ssp. *teretifolium* (Lamarck) Syme (1865); **incl.** *Sedum micranthum* Bastard (1809) $\equiv$ *Sedum album* var. *micranthum* (Bastard) De Candolle (1828) $\equiv$ *Sedum album* ssp. *micranthum* (Bastard) Syme (1865) $\equiv$ *Oreosedum album* var. *micranthum* (De Candolle) P. V. Heath (1987) $\equiv$ *Oreosedum album* ssp. *micranthum* (De Candolle) Velayos (1989); **incl.** *Sedum turgidum* Bastard (1809) $\equiv$ *Sedum album* var. *turgidum* (Bastard) De Candolle (1828); **incl.** *Sedum athoum* De Candolle (1828) $\equiv$ *Sedum album* ssp. *athoum* (De Candolle) Maire & Petitmengin (1908); **incl.** *Sedum clusianum* Gussone (1842) $\equiv$ *Sedum album* var. *clusianum* (Gussone) Arcangeli (1882) $\equiv$ *Sedum album* ssp. *clusianum* (Gussone) J. A. Huber (1936) $\equiv$ *Sedum album* [?] *clusianum* (Gussone) Sampaio (1947); **incl.** *Sedum transbaikalse* Schlechtendal ex Ledebour (1843) (*nom. inval.*, Art. 32.1c?); **incl.** *Sedum album* ssp. *eu-album* Syme (1865) (*nom. inval.*, Art. 26.1); **incl.** *Sedum album* var. *brevifolium* Boissier (1872); **incl.** *Sedum album* fa. *chloroticum* Lamotte (1875); **incl.** *Sedum album* var. *glanduliferum* Ball (1878); **incl.** *Sedum album* var. *typicum* Franchet (1885) (*nom. inval.*, Art. 26.1); **incl.** *Sedum album* fa. *genuinum* Battandier (1889) (*nom. inval.*, Art. 26.1); **incl.** *Sedum serpentini* Janchen (1920) $\equiv$ *Sedum album* ssp. *serpentini* (Janchen) J. A. Huber (1936) $\equiv$ *Oreosedum serpentini* (Janchen) Grulich

(1984); **incl.** *Sedum album* fa. *murale* Praeger (1921); **incl.** *Sedum album* fa. *lilacinum* Beck (1922); **incl.** *Sedum clusianum* fa. *purpureum* Pau & Font Quer (1928) $\equiv$ *Sedum album* fa. *purpureum* (Pau & Font Quer) Maire (1932); **incl.** *Sedum album* var. *purpureum* Maire (1929); **incl.** *Sedum album* var. *genuinum* Hamet (1929) (*nom. inval.*, Art. 24.3); **incl.** *Sedum vermiculifolium* P. Fournier (1935); **incl.** *Sedum gombertii* Sennen (1936); **incl.** *Sedum paniculatum* Kitaibel (1936); **incl.** *Sedum album* var. *sabulicola* Sampaio (1947) (*nom. inval.*, Art. 36.1).

[1] Laxly caespitose perennial herbs with basally densely glandular-pubescent, creeping stems with short ascending non-flowering shoots; **L** alternate, patent or appressed, sessile and scarcely spurred, linear-cylindrical to ovoid-globose, obtuse or rounded, subterete but somewhat flattened on the upper face, glabrous or sparsely pubescent, green but often reddish, 4 - 20 (-25) mm; flowering **Br** erect, 5 - 18 (-30) cm; **Inf** many flowered rather dense subcorymbose cymes, freely branched, bracteate; **Bra** 1 per **Fl**, small; **Ped** short; **Fl** 5-merous; **Sep** broadly sessile, basally connate, ovate to triangular, 1 - 2 mm; **Pet** free, lanceolate, 2 - 4.5 mm, subacute, white or rarely pink; **Fil** white; **Anth** red; **NSc** spatulate; **Sty** slender, to 1 mm; **Fr** erect, whitish; **Se** oblong or ovoid, pale, yellowish-brown, costate. – *Cytology*: $2n = 34, 51, 68, 85, 102, 136$.

A very variable species, esp. in the size and shape of the leaves and flowers. Although some segregate taxa (Maire 1977: 341-343) seem sufficiently distinct to be given specific or subspecific rank, intermediate plants are so numerous as to make their diagnosis impossible.

S. album was recently also recorded from Iran (Akhiani 2000), and this constitutes a considerable range extension [Ed.].

S. alexanderi Egli (KuaS 52(8): 206, ill., 2001). **T**: Mexico, Oaxaca (*MacDougall* s.n. [NY]). – **D**: Mexico (Oaxaca: Cerro Guiengola). **Fig. XXXII.e, XXXII.f**

Incl. *Sedum platyphyllum* Alexander (1942) (*nom. illeg.*, Art. 53.1).

[1] Glabrous perennial shrubs with pale yellow bluish-glaucous succulent stems to 15 cm long and 1 cm thick; **L** alternate, obovate to orbicular, rounded, slightly mucronate, base cuneate, to 7.5×5 cm, 5 mm thick, spreading, upcurved; flowering **Br** erect, to 30 cm; **Inf** panicles with strongly red-streaked rachis, glaucous; **Bra** obovate, to 3 cm, 7 mm thick; **Fl** 5-merous; **Sep** linear-lanceolate, acute, pruinose on the outer face, 5 - 6 mm, spreading; **Pet** free to the base, lanceolate, acute, apiculate, tapering abruptly into a broad claw at the base, greenish-white, speckled with red, 8 - 9 mm; **Anth** brown-red; **NSc** subquadrate, cuneate, truncate, emarginate, greenish-cream; **Sty** slender, spreading, ± 2 mm.

Closely related to *S. allantoides* with terete leaves and similar inflorescences and flowers. – [H. 't Hart & U. Eggli]

S. alfredii Hance (J. Bot. 8: 7, 1870). **T**: China, Guangdong (*Hance* 15605 [K]). – **D**: Japan (Kyu-shu, Ryukyu), Korea, Tibet, China, Taiwan, Philippines; lowlands to 3000 m. **I**: Fröderström (1931: 94, t. 57, 59); Fu & Fu (1984: t. 32).

Incl. *Sedum stellatum* Loureiro (s.a.) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum formosae* Gray in sched. (s.a.) (*nom. inval.*, Art. 29.1).

[1] Perennial or annual herbs (no vegetative shoots present); **L** alternate or opposite, $\pm$ crowded, broadly spatulate-oblong to obovate, subacute, obtuse or retuse, 5 - 15 mm, sometimes mamillate towards the tip; flowering **Br** numerous, ascending, slender, tufted, 10 - 20 cm; **Inf** lax cymes with ± 3 cincinni; **Bra** L-like, ovate; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, unequal, broadly oblanceolate to semi-oblong, subacute to retuse, 2.5 - 5 mm; **Pet** narrowly lanceolate to semi-oblong, shortly mucronate, yellowish, 4 - 5 mm; **NSc** rectangularly spatulate; **Fr** basally connate, $\pm$ spreading; **Se** reticulate-papillose. – *Cytology*: $2n = 124$.

Most probably hapaxanth and now and again propagating through rooting non-flowering branches. Fröderström (1930) included *S. bulbiferum* and *S. makinoi* in *S. alfredii* as separate subspecies, and according to Fu & Fu (1984), *S. formosanum* is also conspecific. Pending further studies, all these taxa are kept as separate species for the time being.

S. allantoides Rose (CUSNH 12(10): 440, t. 79, 1909). **T**: Mexico, Oaxaca (*Purpus* 417 [US 574992]). – **D**: Mexico (Oaxaca); 2100 - 2400 m. **I**: Fröderström (1936a: 23). **Fig. XXXII.d**

[1] Perennial subshrubs, much branched from near the base, with erect sometimes reclining **Br** 20 - 30 cm tall; **L** alternate, closely set, crowded above, almost at right angles from the stem, subspatulate or clavate, rounded, terete, $20 - 45 \times 8 - 12$ mm, very pale green, glaucous; flowering **Br** erect; **Inf** loose panicles; **Bra** L-like but smaller; **Fl** 5-merous, long pedicellate; **Sep** broadly sessile, nearly equal, ovate, acute, ± 6 mm, widely spreading; **Pet** free to the base, lanceolate, oblong, subobtusate to acute, mucronate, greenish-white, ± 7.5 mm; **Anth** pink; **Sty** rather short; **NSc** conspicuous, subquadrate, emarginate, $\pm 1.2 \times 1$ mm, white; **Se** ovoid, reticulate. – *Cytology*: $2n = 58, 116$.

S. alpestre Villars (Prosp. Hist. Pl. Dauphiné 49, 1779). – **Lit**: Jalas & al. (1999: 88-89). **D**: Mountains of C and S Europe and N Anatolia, from the Vosges and the Carpathians to the Pyrenees, Sardinia, Macedonia and Greece; rocky places and rock fissures, 1500 - 3000 m, usually calcifuge. **Fig. XXXII.c**

Incl. *Sedum pseudo-atratum* Schur (s.a.); **incl.**

Sedum rubens Mattuschka & Haenke (1778) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum saxatile* Allioni (1785) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum guettardii* Balbis (1804); **incl.** *Sedum repens* Schleicher ex De Candolle (1815); **incl.** *Sedum scheuchzeri* Schleicher (1823); **incl.** *Sedum erythraeum* Grisebach (1843).

[1] Glabrous tufted perennial herbs with numerous ascending, creeping and rooting non-flowering shoots; **L** alternate, imbricate, sessile, very shortly spurred, oblong to elliptic-oblong, 4 - 6 mm, obtuse, somewhat flattened, bright green often streaked with red; flowering **Br** ascending, usually simple, 5 - 8 cm; **Inf** few-flowered cymes usually with 2 **Br**; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile; **Sep** broadly sessile, unequal, oblong, to 4 mm, obtuse; **Pet** free, oblong, 3.5 - 4 mm, subacute, dull yellow sometimes flushed red or reddish; **Fil** yellow; **Anth** small, yellow; **Sty** usually very short; **NSc** oblong-linear, emarginate; **Fr** spreading, pale brown, with narrow lips along the ventral suture; **Se** ovoid, pale brown or reddish-brown, reticulate or reticulate-papillose. – *Cytology*: 2n = 16.

S. erythraeum, described from W Macedonia (Greece) and also recorded elsewhere in the C Balkans, is a dwarfed form (± 2 cm) with small leaves (± 2.5 mm), reddish (purple when dry) petals, and long styles. In contrast to the common short-styled form of *S. alpestre*, which is predominantly autogamous, *S. erythraeum* is allogamous. *S. alpestre* belongs to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. alsinefolium Allioni (Fl. Pedem. 2: 119, 1785). **T**: Italy, Piedmont (Allioni s.n. [F]). – **D**: NW Italy (Piedmont, N Liguria). **Fig. XXXII.a**

= *Oreosedum alsinefolium* (Allioni) Grulich (1984); **incl.** *Sedum ellipticum* Miègeville (1867).

[1] Fragile much-branched erect annuals, to 15 cm tall, glandular-pubescent throughout; **L** alternate, flat, spatulate or pseudopetiolate with an oblong or elliptic lamina, sometimes subsessile, to 15 (-20) $\times$ ± 8 mm, obtuse or rounded, green or reddish-brown; **Inf** usually many-flowered cymes, laxly branched; **Ped** (5-) 9 (-15) mm; **Fl** 5-merous, 7 - 9 mm $\varnothing$, reflexed before anthesis; **Sep** broadly sessile, equal, linear-oblong to elliptic or triangular-ovate, 2 $\times$ 0.6 mm; **Pet** basally connate for 2 - 3 mm, lobes broadly ovate to cordate, 2.5 - 3.5 $\times$ 2.5 - 3 mm, long acuminate, white; **Fil** white; **Anth** red or pink, rarely yellowish; **Sty** ± 1 mm; **NSc** spatulate, red; **Fr** erect, whitish; **Se** black or dark brown, shiny, costate. – *Cytology*: 2n = 26.

Frequently described as perennial, e.g. by Pignatti (1982: 501). Closely related to the vicariant *S. fragrans* (Ser. *Alsinefolia*), which is endemic to the French Alps. Artificial hybrids between the 2 species are sterile.

S. $\times$ amecamecanum Praeger *pro sp.* (J. Bot. 55:

43, 1917). **T**: not located. – **D**: Mexico?; probably known from cultivation only.

= $\times$ *Sedadia amecamecana* (Praeger *pro sp.*) Moran (1975).

[1] Glabrous perennial subshrubs with many widely spreading **Br** and shorter sterile **Br**, 20 - 30 cm tall; **L** alternate, oblanceolate, subacute, reflexed, slightly spurred, flat, 15 - 20 $\times$ ± 6 mm, light green; flowering **Br** erect to ascending; **Inf** densely cymose to corymbose; **Bra Sep**-like; **Fl** 5-merous; **Sep** basally free, shortly spurred, unequal, broadly linear, obtuse, 4 - 6 mm, green; **Pet** basally slightly connate, oblong, subobtusate, shortly mucronate, 8 - 9 mm, pale yellow; **Fil** and **Anth** yellow; **NSc** square, emarginate, flat, white to yellowish; **Se** subovoid, reticulate-papillose.

Trager & Kimnach (CSJA 67: 102, 1995) reported this to represent the hybrid *S. dendroideum* var. *monticola* $\times$ *S. goldmanii* (as *Villadia batesii*).

S. amplexicaule De Candolle (Mém. Agric. Soc. Agric. Dép. Seine 11: 12, 1808). **T**: France (De Candolle s.n. [G-DC]). – **Lit**: 't Hart (1978). **D**: Mediterranean region from Morocco, Portugal and Spain to Greece and Turkey.

= *Sedum tenuifolium* var. *amplexicaule* (De Candolle) Maire (1977) (*incorrect name*, Art. 11.1) = *Petrosedum amplexicaule* (De Candolle) Velayos (1989); **incl.** *Sedum boryanum* De Candolle (1828); **incl.** *Sedum amplexicaule* var. *ciliatum* Lange (1878) = *Sedum tenuifolium* var. *ciliatum* (Lange) Fröderström (1932).

[2] Glabrous perennials, often with pale yellowish-green colour; sterile shoots short, in midsummer with a terminal propagulum covered by the densely imbricate, broad, 3-lobed basal spurs of dead **L**; **L** loosely imbricate (except for the propagules), linear-oblong, mucronate, terete, with a broad 3-lobed spur, 10 - 20 mm, green or glaucous, margin sometimes fimbriate; flowering **Br** erect or ascending, 6 - 20 (-30) cm; **Inf** terminal cymes with 2 - 3 ascending lax cincinni, drooping in bud; **Bra L**-like; **Fl** (5-) 6- to 8- (to 12-) merous, subsessile; **Sep** basally connate, equal, triangular-ovate, acuminate, ± 4 mm; **Pet** free, oblong, yellow with red mid-vein, 6 - 8 (-10) mm, spreading; **Fil** yellow, basally densely papillate; **Anth** yellow; **NSc** transversely oblong; **Fr** erect, pale brown; **Se** oblong, truncate, brown, costate.

S. amplexicaule ssp. *amplexicaule* – **D**: SW Europe (France, Spain, Portugal), NW Africa (Algeria, Tunisia, Morocco).

Incl. *Sedum rostratum* Tenore (1811); **incl.** *Sem-pervivum anomalum* Lagasca (1816); **incl.** *Sedum carinatum* Link ex Sprengel (1825); **incl.** *Sedum tenuifolium* ssp. *ibericum* 't Hart (1974) = *Petrosedum tenuifolium* ssp. *ibericum* ('t Hart) Grulich (1984).

[2] Stolons usually stout, 0.5 - 5 (-10) cm long;

cincinni of the **Inf** often forked, lax, with 10 - 20 or more **Fl**. – *Cytology*: $2n = 24, 36, 48, 60, 72$.

S. amplexicaule ssp. **tenuifolium** (Sibthorp & Smith) Greuter & Burdet (Willdenowia 11: 277, 1981). **T**: [lecto – icono]: Sibthorp, Fl. Graec. – **D**: C and E Mediterranean region (Italy incl. Sardinia and Sicily, Macedonia, Albania, Bulgaria, Greece incl. Crete, Turkey).

≡ *Sempervivum tenuifolium* Sibthorp & Smith (1809) ≡ *Sedum tenuifolium* (Sibthorp & Smith) Strobl (1884) ≡ *Petrosedum amplexicaule* ssp. *tenuifolium* (Smith) Velayos (1989); **incl.** *Sedum tenuifolium* ssp. *tenuifolium*.

[2] Stolons usually filiform, (5-) 10 - 30 cm; **Inf** often dense, few-flowered; **Fl** large. – *Cytology*: $2n = 48, 72, 96$.

S. andegavense (De Candolle) Desvaux (Observ. Pl. Angers 150, 1818). **T**: France (*Bastard* s.n. [not located]). – **Lit**: Jalas & al. (1999: 105). **D**: Spain, Portugal, C and S France, Corsica, Sardinia, N Africa (Morocco).

≡ *Crassula andegavensis* De Candolle (1815) ≡ *Sedum caespitosum* var. *andegavense* (De Candolle) Rivas Goday & Bellot (1949); **incl.** *Sedum atratum* Bast. ex Lamarck & De Candolle (1815) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula globulifolia* Moris (1827); **incl.** *Sedum commutatum* Sprengel ex Steudel (1841).

[1] Small annual herbs, almost completely glabrous, with erect stems, sometimes branched from the base, to 6 (-10) cm tall; **L** alternate, subopposite and densely imbricate on young plants, obovate to (sub-) globose, sessile, rounded, terete, dull, dark green, to 5 mm; **Inf** cymes with (1-) 2 (-3) usually few-flowered erect cincinni; **Bra** oblong, to 2 mm; **Ped** 1 - 2 mm; **Fl** 4- or 5-merous with 4 or 5 **St**; **Sep** broadly sessile, basally connate for 0.5 mm, broadly ovate, rounded or obtuse, 2 - 2.5 mm; **Pet** basally free, ovate-lanceolate, acute or shortly acuminate, white or pinkish, ± 3 mm; **Fil** white; **Anth** red or yellowish; **Sty** short; **NSc** linear, narrowing towards the base, ± 1 mm; **Fr** erect, dark blackish-brown; **Se** pear-shaped, dark black-brown, bipapillose. – *Cytology*: $2n = 50$.

Closely related to *S. candollei* and *S. pedicellatum* ('t Hart & al. 1999). The 3 species form a comparium and have been classified in Ser. *Pedicellata*. *S. andegavense* is strictly protected in France.

S. andinum Ball (JLSB 22: 35, 37, 1885). – **D**: Peru (Lima: valley of the Río Rimac); ± 4000 m.

≡ *Villadia andina* (Ball) Baehni & Macbride (1937).

[1] Tufted perennial herbs with many slender leafy **Br**; **L** alternate, small, semiglobose; flowering **Br** suberect; **Inf** few-flowered; **Fl** 5-merous, sessile or subsessile; **Sep** basally free, slightly spurred, ov-

ate-elliptic, almost as long as the **Pet**; **Pet** basally connate, lanceolate or oblong, subobtusate, dark red.

S. anglicum Hudson (Fl. Angl., ed. 2, 196, 1778). – **Lit**: Jalas & al. (1999: 85). **D**: Atlantic parts of W Europe, from Portugal to Great Britain and Ireland to S Scandinavia. **I**: KuaS 53: 69-70, 2002.

incl. *Sedum anglicum* var. *hibernicum* Don (s.a.); **incl.** *Sedum anglicum* var. *microphyllum* Don (s.a.); **incl.** *Sedum oblongum* Haworth (1812); **incl.** *Sedum anglicum* var. *raji* Lange (1857); **incl.** *Sedum hudsonianum* Lange (1857) ≡ *Sedum anglicum* var. *hudsonianum* (Lange) Willkomm (s.a.); **incl.** *Sedum pyrenaicum* Lange (1857) ≡ *Sedum anglicum* var. *pyrenaicum* (Lange) Sampaio (1947) ≡ *Sedum anglicum* ssp. *pyrenaicum* (Lange) Laínz (1963); **incl.** *Sedum anglicum* var. *minus* Praeger (1921).

[1] Glabrous perennial herbs with trailing and rooting much-branched shoots forming dense mats or tufts, often reddish; **L** alternate, loosely imbricate, sessile with a short spur, ovoid to subglobose, 2 - 10 $\times$ 2.5 - 4.5 mm, obtuse, dark green (to blue-green), sometimes reddish; flowering **Br** ascending, usually simple, to 12 cm tall; **Inf** cymes with (1-) 2 (-4) usually simple cincinni; **Bra** 2 per **Fl**; **Ped** 0.5 - 1.5 mm; **Fl** 5-merous; **Sep** basally free, spurred, unequal, elliptic, 1.5 - 5 mm, obuse; **Pet** free, oblong-lanceolate, 3.5 - 9 mm, acute-acuminate, white and often tinged red; **Fil** white; **Anth** red; **NSc** spatulate, red; **Sty** slender; **Fr** stellately patent, brown, with distinct lips along the suture; **Se** ovoid, dark red or reddish-brown, reticulate-papillose. – *Cytology*: $2n = 24, 24-36, 48, 120, \pm 144$.

Plants of Great Britain, Ireland and S Scandinavia are usually somewhat smaller and than plants from Spain, Portugal and S France (Pyrennees). Although the N plants are also highly polyploid, the 2 forms cannot be separated unequivocally, and consequently it seems to be merely confusing to distinguish 2 subspecies, as done by Webb (1963) etc.

To include *S. melanatherum* here is incorrect (see *S. melanatherum*). *S. anglicum* belongs to the comparium of Ser. *Anglica* 't Hart ('t Hart 1991). – [H. 't Hart]

S. angustifolium Z. B. Hu & X. L. Huang (Acta Phytotax. Sin. 19(3): 311, 1981). **T**: China, Zhejiang (Huang 7604 [SH]). – **D**: E China (Anhui, Sichuan, Beijing, Zhejiang, Liaoning); 200 - 600 m.

[1] Perennial herbs, with 15 - 22 cm long stolons; **L** in whorls of 3, linear-lanceolate to linear, shortly spurred, 15 - 27 $\times$ 3 - 5 mm; flowering **Br** 4 - 7 cm; **Inf** cymes with 3 - 5 cincinni; **Bra** L-like, with purplish-brown spots above the middle, 9 - 12 $\times$ ± 2 mm; **Fl** 5-merous, subsessile; **Sep** L-like, with purplish-brown spots above the middle, $\pm 6 \times 1$ mm; **Pet** lanceolate, acute, yellow, 7 - 8 $\times$ 1 - 1.5 mm; **NSc** square-cuneate, broadly rounded; **Fr** subdivergent.

The spots on the sepals and bracts are not dif-

ferentiating characters, as stated by Hsu (1991). They are also found in allied species such as *S. sarmentosum* and *S. jiuhuashanense* (Hsu & al. 1983: 37). In fact, Fu & Ohba (2001: 250) treat this taxon as straight-forward synonym of *S. sarmentosum*.

S. anhuiense S. H. Fu & X. W. Wang (Bull. Bot. Res., Harbin 6(4): 137-139, ill., 1986). **T:** China, Anhui (*Hsiao & Tan* 503 [Herb. Anhui Inst. Biol., HIB]). – **D:** China (Anhui); known from the type locality only.

[1] Glabrous annual herbs with simple or little-branched stems 8 - 15 cm tall; **L** opposite or almost whorled at the base and alternate near the top, narrowly obovate to narrowly lanceolate, long acuminate, bluntly spurred, 5 - 6.5 × ± 1 mm; **Inf** moderately elongate, with lax pleiochasial few-flowered cymes; **Bra** narrowly lanceolate; **Ped** 3 - 4 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, broadly linear, 1 - 2 × ± 0.5 mm; **Pet** lanceolate, shortly mucronate, slightly recurved at the tip, colour unknown, 3 - 3.5 × ± 1 mm; **Sty** long; **NSc** square, slightly emarginate; **Fr** suberect, many-seeded.

Treated as synonym of *S. lineare* by Fu & Ohba (2001: 250).

S. annuum Linné (Spec. Pl. [ed. 1], 432, 1753). **T:** LINN 595.9. – **Lit:** Jalas & al. (1999: 92-93). **D:** N Europe, Iceland, most of the mountain ranges of C and S Europe and throughout Anatolia and Iran; gravelly places, to 3000 m.

≡ *Enchylus annuus* (Linné) Ehrhart (1789) (*nom. inval.*, Art. 43.1) ≡ *Etiosedum annuum* (Linné) A. Löve & D. Löve (1985); **incl.** *Sedum parnassicum* Boissier & Heldreich in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sedum rupestre* Oeder (1770) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum oederi* Retzius (1779); **incl.** *Sedum saxatile* G. H. Weber ex F. H. Wiggers (1780); **incl.** *Sedum aestivum* Allioni (1785); **incl.** *Sedum saxatile* Willdenow (1799) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum divaricatum* Lapeyrouse (1813) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum annuum* var. *perdurans* Murbeck (1892); **incl.** *Sedum zollikoferi* F. Hermann & Stefanoff (1935); **incl.** *Sedum hewittii* Chamberlain (1972) ≡ *Oreosedum hewittii* (Chamberlain) Grulich (1984).

[1] Glabrous erect annual or rarely biennial herbs to 12 (-20) cm tall, with simple stems or branched from the base; **L** alternate, sessile with a short broad truncate spur, oblong-elliptic to linear-elliptic, to 6 mm, obtuse or rounded, terete to subterete, bright green; **Inf** lax cymes with (3-) 5 - 15 (-25) **Fl** on (1-) 2 (-3) monochasial **Br**, rarely with subsidiary **Inf**; **Bra** 2 per **Fl**; **Fl** 5-merous, subsessile or on short **Ped**; **Sep** broadly sessile, unequal, oblong-elliptic, to 3 mm, obtuse or rounded; **Pet** oblanceolate to elliptic, ± 5 mm, acute to acuminate, yellow, sometimes tinged with red; **Fil** yellow; **Anth** globose-oblong, yellow; **Sty** slender; **NSc** oblong to square, emarginate, yellow; **Fr** divergent to stel-

lately patent, pale brown or yellowish, with small lips along the suture; **Se** oblong-ovoid, orange-red, reticulate-papillose. – *Cytology*: 2n = 22.

Normally biennial in Fennoscandia, but apparently annual in C Europe. The var. *perdurans* is a perennial variant with decumbent branches that root in the soil, occurring sporadically in populations in the Balkan mountains and the Carpathians. The species belongs to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. aoikon Ulbrich (Notizbl. Bot. Gart. Berlin-Dahlem 7: 111-112, 1917). **T:** B. – **D:** Mexico (probably Veracruz, between Orizaba and Boca del Monte). **I:** Clausen (1959: 83).

Incl. *Sedum purpusii* Rose (1905).

[1] Perennial subshrubs to 1 m tall with flexuous **Br**; **L** alternate, spatulate-ovate, obtuse, to 45 mm long and wide; flowering **Br** erect or ascending, lateral; **Inf** dense cymes or panicles, with numerous short few-flowered **Br**; **Fl** 5-merous, subsessile; **Sep** basally free, shortly spurred, unequal, lanceolate or linear-lanceolate, obtuse, 1.5 - 2 mm; **Pet** free to near the base, lanceolate, acute, yellowish, to 5 mm; **Sty** rather long; **Fr** widely divergent; **Se** ellipsoid, reticulate.

S. purpusii is here placed as synonym following Clausen (1959: 86), but would have priority.

S. apoleipon 't Hart (Willdenowia 13(2): 310-311, ill., 1983). **T:** Greece, Eritania ('t Hart 37-136 [U]). – **D:** Greece; mountains, semidry stony meadows and in open rocky places, on limestone, 1700 - 2000 m.

[1] Glabrous perennials, non-flowering shoots procumbent or trailing, branching and rooting, usually forming dense mats; **L** alternate, sessile, densely imbricate on the non-flowering shoots, oblong-ellipsoid, shortly spurred, terete, obtuse, 4 - 8 mm, glaucous-green; dead **L** persistent, reddish-brown; flowering **Br** erect, 5 - 8 cm; **Inf** dense cymes with 2 or 3 cincinni; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile to subsessile; **Sep** broadly sessile, unequal, obtuse to rounded, to 3 mm; **Pet** lanceolate to elliptic-ovate, acuminate, ± 5 mm, yellow; **Fil** yellow; **Anth** yellow; **Sty** ± 1 mm; **NSc** spatulate to oblong-cuneate, emarginate; **Fr** dark brown with distinct brown lips along the suture; **Se** brown, reticulate-papillose. – *Cytology*: 2n = 44.

This taxon has formerly been confused with *S. sexangulare*, but can easily be distinguished from the latter by its densely imbricate alternate glaucous leaves. It hybridizes with *S. laconicum* in nature (= *S. ×patrickii*), and belongs to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. arenarium Brotero (Fl. Lusit. 2: 212, 1805). – **D:** Portugal to W and C Spain; abundant on sandy and gravelly places.

≡ *Sedum anglicum* ssp. *arenarium* (Brotero) Coutinho (1913); **incl.** *Sedum anglicum* [?] *arenarium* Sampaio (1947) (*nom. inval.*, Art. 36.1).

[1] Glabrous annual herbs with erect or spreading and ascending shoots, shoots usually basally much branched, often red, to 10 (-12) cm tall; **L** alternate, sessile with a short spur, ovoid to oblong and terete or semiterete, 3 - 4.5 mm, obtuse, bright green often tinged red; **Inf** cymes with 2 - 3 cincinni; **Bra** 2 per **Fl**; **Ped** 0.5 - 1 mm; **Fl** 5-merous; **Sep** basally free, spurred, unequal, oblong or elliptic, to 2.5 mm, obtuse; **Pet** free, lanceolate, acuminate, 3 - 5 mm, white, often tinged red; **Fil** white; **Anth** red; **NSc** spatulate, red; **Sty** slender; **Fr** suberect to spreading or stellately patent, brownish or whitish, with narrow lips along the suture; **Se** ovoid, dark red or reddish-brown, reticulate-papillose. – *Cytology*: 2n = 24, 48.

A very variable species, belonging to the comparium of Ser. *Anglica* 't Hart ('t Hart 1991). – [H. 't Hart]

S. assyriacum Boissier (Diagn. Pl. Orient. 1(6): 77, ill., 1845). – **D**: Near East ("Mesopotamia"; Iraq, Iran?, Lebanon / Syria).

Incl. *Sedum assyriacum* var. *minus* Boissier ex Fröderström (1932) (*nom. inval.*, Art. 32.1c?).

[2] Completely glabrous annuals without sterile stems; flowering stems erect or arcuate, branched in the upper ½, to 10 cm tall; **L** (only upper **L** known) linear to oblanceolate, 5 - 20 mm; **Inf** several-flowered, with large **L**-like oblong **Bra**; **Fl** 5- to 6-merous, almost sessile; **Sep** lanceolate, ± 2 mm; **Pet** broadly lanceolate, subacute, ± 5 mm, probably yellow; **St** often only 1 whorl present, slightly shorter than the **Pet**; **Ca** basally connate, suberect.

A little-known taxon, placed between *S. rubens* and *S. palaestinum* (here treated as *S. eriocarpum* ssp. *orientale*) by Fröderström (1932)

S. nanum is perhaps nothing more than an ecotype of *S. assyriacum*, and 't Hart & Alpinar (2000: 132) further include *S. caroli-henrici* and *S. yildizianum* as synonyms. – [U. Eggli]

S. atratum Linné (Spec. Pl., ed. 2, 1673, 1763). **T**: LINN 595.10. – **Lit**: Jalas & al. (1999: 116-117). **D**: SW, C and SE Europe (Pyrenees, Alps, W Carpathians, Appennini, mountains of the Balkan peninsula), E-wards to Slovakia, W Ukraine and Romania; common on limestone rocks and gravel, 1000 - 3200 m. **I**: Lippert (1995: 126-127).

≡ *Sedella atrata* (Linné) Fourreau (1868) (*incorrect name*, Art. 11.4); **incl.** *Sedum atratum* var. *viride* E. P. Perrier (s.a.); **incl.** *Sedum haematodes* Scopoli (1772) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum rubens* Jacquin ex Nyman (1879) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum atratum* var. *carinthiacum* Hoppe ex Pacher (1885) ≡ *Sedum carinthiacum* (Hoppe ex Pacher) Fritsch (1897) ≡ *Sedum atratum* ssp. *carinthiacum* (Hoppe ex Pacher) D. A. Webb (1964) ≡

Sedella carinthiaca (Hoppe ex Pacher) A. Löve & D. Löve (1985) (*incorrect name*, Art. 11.4); **incl.** *Sedum erubescens* Sennen (1927).

[1] Usually biennial herbs, 2 - 8 cm tall, glabrous, yellowish-green to glaucous-green, usually flushed with dark purple, esp. in dry conditions and when flowering; **R** fibrous; young plants as sessile **Ros** with congested **L**; **L** narrowly clavate, almost terete, obtuse, 4 - 9 mm; flowering plants with erect, simple or branched stem and more distant **L**; **Inf** almost corymbose; **Fl** ± sessile, 5-merous, ± cup-shaped; **Sep** ± 2 mm, triangular-ovate, somewhat acute; **Pet** remaining erect or slightly spreading, 3 - 4 mm, whitish, greenish or reddish; **Fr** stellately spreading; **Se** oblong-ovate, pale brown, longitudinally wrinkled. – *Cytology*: 2n = 16.

The colour forms (red vs. yellowish-green) are commonly distinguished as subspecies, but they sometimes occur sympatrically, and their taxonomical value therefore appears to be doubtful. – [U. Eggli]

S. australe Rose (Bull. New York Bot. Gard. 3(9): 41, 1903). **T**: Guatemala (*Nelson* 3707 [US]). – **D**: Guatemala.

[1] Glabrous perennial subshrubs with procumbent tuberculate stems, rooting at the nodes; **L** densely imbricate, alternate, obtuse, terete, ± 6.5 mm; **Inf** short compact corymbs; **Fl** 5-merous; **Sep** broadly sessile, obtuse, ± 3.5 mm; **Pet** mucronate, reddish-yellow, ± 7 mm; **Fr** widely spreading. – *Cytology*: 2n = ± 200.

S. aytacianum J. Metzger (CSJA 66(6): 259-261, ill., 1994). **T**: Turkey, Trabzon (*Metzger* 2046.1 [GAZI, BASBG]). – **D**: NE Turkey (NE Anatolia, SE of Trabzon); limestone rocks, 1800 m. **Fig. XXXIII.a**

[1] Perennial herbs; stems decumbent, sterile stems 1.2 - 2 cm, basally usually **L**-less and **L** crowded in **Ros** at the **Br** tips, outer **L** 10 - 12 × 2 mm, ± 3× as large as the inner **L**, all **L** subulate, obtuse; flowering **Br** erect, to 8 cm, unbranched, basally glabrous, hirsute towards the tip, **L** alternate or in verticils of 3, bristly-hairy; **Inf** cymes with 1 - 3 **Br** with up to 7 **Fl** each; **Ped** 2.5 - 3 mm (longer in terminal **Fl**); **Fl** (5- to) 6- to 7- (to 8-) merous, 12 - 13 mm Ø; **Sep** semi-erect, acute, hirsute, basally connate; **Pet** free, spreading, broadly ovate, acute or almost apiculate, 4.5 × 3 mm, white with broad green base, outside hairy; **NSc** small, irregularly pear-shaped, yellow; **Ca** strongly pubescent; **Se** not described.

Compared with *S. hispanicum* in the protologue, and treated as synonym of this taxon by 't Hart & Alpinar (2000: 133). – [U. Eggli]

S. baileyi Praeger (Proc. Roy. Irish Acad., Sect. B, 35: 4, 1919). **T**: not located. – **D**: China (Guangxi, Guangdong, Hunan, Jiangxi); rock crevices, to 900 m. **I**: Fu & Fu (1984: t. 33).

[1] Glabrous perennial herbs with long creeping and rooting non-flowering **Br**; **L** decussate, obovate-spatulate, acute, shortly spurred, cuneate, flat, $\pm 15 \times 6$ mm; flowering **Br** to 7 cm; **Inf** few-flowered cymes with ± 3 cincinni; **Bra** obovate, **L**-like but smaller; **Fl** 5-merous; **Sep** basally free, spurred, oblong-linear, 1.5 - 2 mm; **Pet** lanceolate, acute and shortly apiculate, yellowish to white, $4 - 5 \times 1.5$ mm; **NSc** rhombic-spatulate, obtuse or rounded; **Fr** divergent, with lips along the ventral suture.

S. baleensis M. G. Gilbert (Bradleya 3: 49-50, ill. (p. 51), 1985). **T**: Ethiopia, Bale Region (*Friis & al.* 3812 [K, C, ETH, UPS]). – **D**: Ethiopia (Bale Region); forest margins and open grassy slopes, 2750 - 3200 m.

[2] Glabrous ascending sometimes branched annual herbs to 10 cm tall; **L** alternate, obovoid-clavate, sessile or slightly spurred, $\pm 6.5 \times 2.5$ mm, obtuse, flattened, green or flushed with pink; **Inf** cymose, with several monochasial **Br**; **Ped** 2.5 - 3.5 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, triangular, ± 1.2 mm, acute; **Pet** lanceolate, $3 - 3.5 \times 2$ mm, long acuminate, white to pale pink with darker midrib; **Fil** 2.5 - 3 mm, white; **Anth** dark (red); **NSc** cuneate to obtriangular; **St** 1.2 mm.

The classification of *S. baleense* in Subgen. *Gormaniana* has still to be ascertained as the testa ornamentation is unknown. However, the small triangular sepals of equal length and the immature seeds strongly suggest inclusion in Subgen. *Gormaniana*.

S. balfourii Hamet (Notes Roy. Bot. Gard. Edinburgh 5(24): 116-117, t. 85, 1912). **T**: Tibet (*Forrest* 196 [E]). – **D**: China, Tibet (borderland to Sichuan); 2750 - 4000 m. **I**: Fröderström (1931: 32, t. 14, 17); Fu & Fu (1984: t. 33).

≡ *Rhodiola balfourii* (Hamet) S. H. Fu (1965) ≡ *Balfouria balfourii* (H. Ohba) H. Ohba (1995) (*incorrect name*, Art. 11.4) ≡ *Ohbaea balfourii* (Hamet) Byalt & I. V. Sokolova (1999); **incl.** *Sedum mossii* Hamet (1913); **incl.** *Sedum orichalcum* W. W. Smith (1916); **incl.** *Sedum banlanense* H. Limp-richt (1922).

[1] Perennial rosulate herbs with short thick **R**-stock; **L** alternate, narrowly oblong or oblong-lanceolate, acute or narrowed into a weak mucro, sessile with clasping base, apical part sometimes ciliate, $5 - 45 \times 0.5 - 1.5$ mm; flowering **Br** axillary, simple, erect or suberect, slender, 10 - 30 cm tall; **Inf** cymes with ± 3 cincinni, these sometimes forked; **Bra** **L**-like but smaller; **Fl** 5- (to 6-) merous, subsessile or shortly pedicellate; **Sep** broadly sessile, basally connate for 0.5 mm, triangular or semi-oblong, acute, often with mamillate tip, ± 3 mm; **Pet** free, oblong, shortly mucronate, often mamillate along the midrib, brass-yellow, 5 - 7 mm, erect at anthesis; **NSc** narrowly linear, subobtuse; **Sty** slender, 4 - 5 mm; **Fr** suberect; **Se** ovate, smooth (to reticulate).

Praeger (1921a) included this species in the *Brevicaulis* group of *Sedum* Sect. *Rhodiola*, whereas Hamet (1929) suggested an affinity with *Rosularia*. Ohba (1995) erected the illegitimate monotypic genus *Balfouria* for this taxon. Later, the replacement name *Ohbaea* was published.

S. barbeyi Hamet (Bull. Soc. Bot. France 56: 45-46, 1909). **T**: China, Hubei (*Henry* 7002 [P, K, LE, Herb. Raymond-Hamet]). – **D**: China (W Henan, NW Hubei, N Shaanxi); humus-rich soils, usually in the shade, 800 - 2400 m. **I**: Fröderström (1931: 50, t. 31).

[1] Perennial herbs with tufted erect stems 2 - 3.5 cm long; **L** densely imbricate, alternate, $\pm$ oblong, acuminate, 4 - 7 mm; flowering **Br** erect, branched, 4 - 8 cm; **Inf** small dense corymbs; **Fl** 5-merous; **Sep** basally free, broadly lanceolate, acuminate, spotted, ± 5 mm; **Pet** basally connate, lanceolate, subacute, submucronate, yellowish, 7 - 8 mm; **NSc** subquadrate, small; **Sty** rather short; **Fr** few-seeded; **Se** large, reticulate-papillose.

S. batallae Barocio (Cact. Suc. Mex. 18(4): 96-100, ills., 1973). **T**: Mexico, Hidalgo (*Rzedowski* 30703 [ENCB]). – **D**: Mexico (Hidalgo); on rocks, ± 2600 m.

[1] Caespitose perennial herbs with a **R**stock and numerous (hundreds) branched prostrate or pendulous stems to 20 cm, forming dense colonies; **L** densely imbricate, alternate, ovoid-elliptic to almost globose, obtuse, somewhat clasping at the base, terete to flat, fleshy, glaucous-green, $3 - 7 \times 2 - 4$ mm; **Inf** solitary **Fl** or few-flowered racemes; **Bra** fleshy; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, almost equal, triangular, $2 - 3 \times \pm 1$ mm; **Pet** ovate-lanceolate, acute, 3 - 5 mm, yellow; **Fil** red; **Anth** red; **NSc** rather small, trapezoid, yellowish; **Fr** divergent, with conspicuous lips along the ventral suture, with several **Se**, red; **Se** oblong, light brown. – *Cytology*: $2n = 68$.

S. batesii Hemsley (Diagn. Pl. Nov. Mexic. 12, 1878). **T**: Mexico (*Bates* s.n. [K]). – **D**: S Mexico to Guatemala. **I**: Fröderström (1936a: 132).

Incl. *Cotyledon galeottiana* Hemsley (1878) ≡ *Altamiranoa galeottiana* (Hemsley) Rose (1905) ≡ *Sedum galeottianum* (Hemsley) Hamet (1929) ≡ *Villadia galeottiana* (Hemsley) H. Jacobsen (1958); **incl.** *Altamiranoa hemsleyana* Rose (1905) ≡ *Villadia hemsleyana* (Rose) H. Jacobsen (1958).

[1] Annual herbs with thickened elongate **R** and erect or diffusely spreading stems, branching from the base; **L** alternate, oblanceolate, obtuse, narrowly spurred, 3.5 - 5 mm; flowering **Br** erect; **Inf** loosely corymbose or with elongated few-flowered cymes; **Bra** **L**-like, ± 2.5 mm; **Fl** 4- to 5-merous, subsessile; **Sep** basally free, shortly spurred, unequal, oblanceolate to oblong, obtuse, ± 4 mm, thick; **Pet** basally slightly connate, oblong or lance-

olate, obtuse, white, 4 - 4.5 mm; **Sty** elongate; **NSc** narrowly linear, slightly emarginate, reddish; **Fr** suberect, few-seeded; **Se** subovoid, reticulate.

Normally encountered in cultivation under the incorrectly applied name *Villadia batesii*.

S. ×battandieri Maire (Bull. Soc. Hist. Nat. Afr. Nord 22: 48, 1931). – **D**: Of garden origin.

[1] Perennial herbs with persistent and much-branched thick succulent stems; **L** in dense **Ros** at the stem tips, linear-oblong, obtuse, with papillae along the margins; flowering **Br** terminal. – *Cytology*: $2n = 54$.

By and large intermediate between its parents *S. multiceps* and *S. tuberosum*, though somewhat closer to *S. multiceps*. – [H. 't Hart]

S. beauverdii Hamet (Bull. Soc. Bot. France 56: 48-50, 1909). **T** [syn]: China, Yunnan (*Delavay* 3527/3527bis [P, Herb. Raymond-Hamet]). – **D**: China (NW Yunnan, W Sichuan); rock crevices or rocks in forests, 3000 - 4000 m. **I**: Fröderström (1931: 50, t. 30); Fu & Fu (1984: t. 21).

[1] Perennial densely tufted herbs with numerous ascending stems, 1 - 7 cm tall; **L** alternate, densely imbricate, linear or broadly triangular, acuminate, with a broad 3- or 4-lobed spur, mamillate towards the tip, 4 - 7 mm; flowering **Br** erect, branched, 4 - 8 cm; **Inf** small dense corymbs; **Fl** 5-merous; **Sep** broadly sessile, basally slightly connate, triangular or lanceolate, acuminate, 4 - 6 mm; **Pet** basally slightly connate, broadly lanceolate, acute, submucronate, yellowish, 5.5 - 8 mm; **NSc** linear-spatulate, truncate or slightly emarginate; **Fr** divergent; **Se** small, reticulate-papillose.

S. bellum Rose ex Praeger (J. Roy. Hort. Soc. 46: 141, fig. 75 (p. 142), 1921). **T**: not located. – **D**: Mexico (Durango); $\pm$ 2000 m. **I**: Fröderström (1936a: 113, t. 75).

Incl. *Sedum farinosum* Rose (1911) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum aleuroides* Bitter (1924).

[1] Perennial herbs with stout erect stems, densely leafy at the top, > 5 cm tall; **L** alternate, obovate to oblong, rounded to obtuse, shortly spurred on flowering **Br**, mamillate, 7 - 35 mm, longest on sterile **Br**; flowering **Br** erect, white-pruinose, 7 - 10 cm; **Inf** cymes with spreading **Br**; **Bra** suboblong, mamillate, $\pm$ 2 mm; **Fl** 5-merous, sessile or subsessile; **Sep** basally free, shortly spurred, unequal, oblong to subovate, mamillate, 3 - 4 mm, erect; **Pet** basally slightly connate, subovate to sometimes lanceolate, obtuse, white, shortly mucronate, narrowed near the base, $\pm$ 7 mm, suberect; **NSc** square-subspatulate, slightly emarginate, yellowish; **Fr** widely spreading; **Se** ovoid, reticulate. – *Cytology*: $2n = 72$.

S. bergeri Hamet (Bull. Mus. Nation. Hist. Nat. 15: 448, 1909). **T**: China, Yunnan (*Anonymus* s.n. [not

located]). – **D**: China (E Yunnan); rocks on slopes, 3000 - 3500 m. **I**: Fröderström (1931: 51, t. 32); Fu & Fu (1984: t. 28).

[1] Perennial herbs with stems 2.5 - 3.5 cm tall; **L** alternate or in whorls (basally), linear-spatulate, subacute, obtusely spurred, 8 - 35 mm; flowering **Br** erect, simple, 9 - 19 cm; **Inf** dense corymbs; **Fl** 5-merous; **Sep** broadly sessile, ovate-oblong, subacute, with papillate tip, 5 - 6 mm; **Pet** free or basally slightly connate, oblong and somewhat narrowed at the base, shortly mucronate, yellowish, 7 - 9 mm; **NSc** broader than long, obtuse; **Sty** rather long; **Fr** divergent; **Se** reticulate-papillose.

S. berillonianum Hamet (BJS 50(Beiblatt 112): 9-10, 1913). **T**: Peru, Ayacucho (*Weberbauer* 5501 [B, US]). – **D**: Peru (Ayacucho); $\pm$ 3000 m.

$\equiv$ *Villadia berilloniana* (Hamet) Baehni & Macbride (1937).

[1] Tufted perennial herbs; **L** alternate, ovate, subobtuse, 4.5 - 7 mm, shortly spurred, spur trilobate; flowering **Br** decumbent, branched at the base, 4.5 - 8 cm; **Inf** loose few-flowered corymbs; **Fl** 5-merous, shortly pedicellate; **Sep** basally free, with short trilobate spur, oblong, subacute, 4 - 5.5 mm; **Pet** basally connate for up to 2.5 mm, oblong, subacute, colour not described, mucronate, $\pm$ 7.5 mm; **NSc** very broadly obovate, emarginate.

S. blepharophyllum Fröderström (Acta Horti Gothob. 15: 26-27, figs. 173-184, t. 6: 1, 1942). **T**: China, Sichuan (*Smith* 12694 [UPS ?]). – **D**: China (W Sichuan); sunny rocks in valleys, stone walls, 3200 - 3800 m.

[1] Annual or biennial somewhat tufted herbs with moderately robust minutely papillose stems, 6 - 14 cm tall; **L** alternate or sometimes opposite, ovate, obtuse, rounded at the base, with short acute papillae in the upper part, 5 - 5.5 mm; flowering **Br** erect or ascending, branched in the upper $\frac{1}{2}$; **Inf** lax corymbs or racemose, $\pm$ 4 cm; **Fl** 5-merous, shortly pedicellate; **Sep** basally free, shortly spurred, oblong, subobtuse, acutely papillose, $\pm$ 4 mm; **Pet** almost free at the base, oblong, subacute, densely papillose at the tip, pale yellow, $\pm$ 4 mm; **NSc** linear-spatulate, obtuse, pale; **Sty** short; **Fr** divergent from the middle; **Se** small, ovoid, reticulate-papillose.

S. bonnierii Hamet (Rev. Gén. Bot. 25: 92, 1913). **T**: China (*Anonymus* s.n. [not located]). – **D**: China (S Shaanxi, E Sichuan); rocks in forests, 500 - 1400 m. **I**: Fröderström (1931: 38, t. 23).

Incl. *Sedum miae* Hamet (s.a.) (*nom. inval.*, Art. 32.1c).

[1] Annual or biennial glabrous tufted herbs; **L** in whorls of 3 - 5, ovate to orbicular, obtuse, narrowly petiolate, 5 - 15 mm; flowering **Br** prostrate or ascending, very slender, 5 - 20 cm; **Inf** 4- to 5-flowered cymes, appearing umbellate; **Ped** slender,

2 - 5× as long as the **Fl**; **Fl** 4- to 5-merous; **Sep** broadly sessile, triangular to semi-oblong, subobtuse, 0.5 - 1.5 mm; **Pet** obovate, subobtuse, narrowed towards the base, white or reddish, 2 - 2.5 mm; **NSc** very small, linear-subspatulate, obtuse; **Fr** only 3 follicles, suberect, each follicle with 3 - 8 **Se**; **Se** oblong, reticulate-papillose.

An insufficiently known species.

S. booleanum B. L. Turner (Phytologia 79(1): 31-34, ill., 1996). **T**: Mexico, Nuevo León (*Hinton & al.* 20468 [TEX]). – **D**: Mexico (Nuevo León: Mpio. Rayones); gypsum hillsides, 1340 m. **I**: Sedum Soc. Newslett. No. 43: t. 10G, 1998.

[?] Perennial (?) herbs with fibrous **R**, 5 - 8 cm tall; stems 3 - 4 mm Ø near the base when dry, papillose; **L** alternate, ovate when dry, 7 - 10 × 3 - 4 mm, gradually becoming smaller towards the stem tips, soon deciduous near the stem bases, somewhat overlapping and covering the stem axis; **Inf** terminal with short circinnate **Br**, 5- to 10-flowered, congested; **Sep** 5, ovate, glabrous; **Pet** ± 3 × 1.5 mm, free to the base, red, with a dorsal keel; **St** 5, alternate with the **Pet**, 3 mm; **Anth** yellow; **Ca** 2.5 mm with erect **Sty** 1 mm long; **Fr** and **Se** not seen.

Said to resemble species of the genus *Villadia*, but with completely free petals and therefore placed in *Sedum*, according to the protologue. – [U. Eggli]

S. borissovae Balkovsky (Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk SSSR 15: 85-89, 1953). **T**: Ukraine (*Anonymus* s.n. [LE]). – **D**: S Ukraine; endemic to granitic outcrops near Dolinsky.

[1] Glabrous perennial herbs with trailing and rooting non-flowering shoots; **L** alternate, imbricate, sessile with a short broad truncate spur, oblong-elliptic, ± 6 mm, obtuse to rounded, semiterete, glaucous or pruinose; flowering **Br** ascending, simple or with some few-flowered lateral **Br**; **Inf** cymes with (1-) 2 (-4) monochasial **Br**; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, unequal, oblong, to 3 mm, obtuse; **Pet** basally free, lanceolate-elliptic, ± 6 mm, acute-acuminate, golden-yellow, often tinged red; **Fil** yellow; **Anth** yellow; **NSc** square; **Sty** slender; **Fr** stellately patent, dark brown with distinct lips along the ventral suture; **Se** ovoid, brownish, reticulate-papillose. – *Cytology*: 2n = 26.

Belonging to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. borschii (R. T. Clausen) R. T. Clausen (Sedum North Amer., 298, 1975). **T**: USA, Idaho ? (*Clausen* 43-52 [CU]). – **D**: NW USA (Idaho, Montana); sites which are too hot and dry for trees, 1270 - 2120 m. **I**: Clausen (1975: 291).

≡ *Sedum leibergii* var. *borschii* R. T. Clausen (1944).

[2] Glabrous perennial herbs with slender decum-

bent stems, with lateral **Br** from lower parts; **L** loosely imbricate, alternate, obovate or elliptic, rarely lanceolate, obtuse, finely papillose at the tip and the margins, subterete, sessile, green, 4.7 - 7.5 × 2.5 - 3.4 mm, divergent; flowering **Br** ascending, 4.7 - 6 cm, appearing angled when dry; **Inf** cymes with 2 or 3 **Br**; **Bra** **L**-like but smaller; **Fl** 5-merous, subsessile; **Sep** broadly sessile, ovate, acute or obtuse, yellow-green, ± 2 × 1.5 mm, erect; **Pet** lanceolate-elliptic, acute, mucronate, appendaged, yellowish, 5 - 6.5 mm, widely spreading; **Fil** yellow; **Anth** yellow; **NSc** square or almost square, sometimes erose, yellow to orange, rarely pale yellow to greenish-white; **Fr** basally connate, widely divergent, papillose or papillose-pubescent, with prominent lips along the ventral suture, brown; **Se** pear-shaped, pale or dark brown, costate. – *Cytology*: 2n = 32, 43-51, 45-54, 50.

S. botteri Hemsley (Diagn. Pl. Nov. Mexic. 1: 10, 1878). **T**: Mexico (*Sessé & al.* s.n. [US, K]). – **D**: SE Mexico (Chiapas, Veracruz); epiphytic, 1200 m. **I**: Fröderström (1936a: 17, t. 10); Clausen (1959: 40).

[1] Perennial subshrubs to 1 m tall with angled stems with prominent ridges; **L** alternate, oblanceolate or obovate, rounded, petiolate, 14 - 71 × 6 - 31 mm; flowering **Br** pendulous; **Inf** lax elongate panicles; **Ped** 1 - 5.6 mm; **Fl** 5-merous; **Sep** basally free, unequal, elliptic-oblong or oblanceolate-elliptic, acute, green, 4.4 - 12.4 × 1.4 - 2.9 mm, spreading; **Pet** lanceolate, acute, mucronate, pale green, ± 8 mm, spreading; **Anth** yellow; **NSc** obovately subquadrate, erose, dark red to pink; **Fr** divergent or erect; **Se** linear, caudate at both ends, reticulate, yellow-brown. – *Cytology*: 2n = 48.

S. bourgaei Hemsley (Diagn. Pl. Nov. Mexic. 1: 11, 1878). **T**: Mexico (*Bourgeau* 933 [K, US 48556]). – **D**: Mexico: C Trans-Mexican Volcanic Belt, 2500 - 3300 m. **I**: Fröderström (1936a: 25, t. 15); Clausen (1959: 148).

[1] Perennial subshrubs with erect, decumbent or pendulous, much branched, smooth stems, lateral **Br** papillose; **L** alternate, linear, obtuse, with a very short basal spur, sessile, terete or subterete, glabrous or minutely papillose, green, 5.3 - 23.5 × 1.2 - 2.4 mm; flowering **Br** erect; **Inf** terminal cymes with 2 - 3 monochasial **Br**; **Fl** 5-merous (rarely 4- or 6-merous), sessile or subsessile; **Sep** basally free, shortly spurred, unequal, lanceolate or oblong, obtuse, minutely spurred, green, 2 - 7.5 × ± 1 mm; **Pet** lanceolate, acute or acuminate, mucronate, somewhat hooded, carinate, white with pale green to pink dorsal keel, ± 6.5 mm, spreading; **Fil** white; **Anth** red, purple or rarely yellow; **NSc** spatulate-oblong, truncate, emarginate, dark purple; **Fr** erect or divergent, with small lips along the ventral suture, pale brown; **Se** ellipsoid, brown, reticulate to reticulate-papillose. – *Cytology*: 2n = 58.

Here belongs *Sedum acre* in the sense of Sessé & Mociño 1887.

S. bracteatum Viviani (Fl. Libyc. Spec. 24, t. 8: fig. 3, 1824). – **D:** Libya (Cyrenaica).

Incl. *Sedum bracteatum* var. *glabrum* Maire & Weiller (1939); **incl.** *Sedum bracteatum* var. *glanduloso-hispidum* Maire & Weiller (1939) (*nom. inval.*, Art. 26.2).

[1] Usually densely glandular-pubescent annuals with erect simple shoots 3 - 10 cm tall; **L** alternate, sessile, oblong to linear, $\pm 10 \times 2.5$ mm, semiterete, obtuse and slightly papillate; **Inf** cymose, usually with 3 monochasial **Br** with 3 - 8 **Fl** each; **Bra** ovoid, 3 - 5 mm; **Fl** 5-merous, sessile; **Sep** broadly sessile, basally connate, triangular, 1 - 2 mm, acute; **Pet** oblong or ovate-lanceolate, 5 - 5.5 mm, distinctly mucronate, slightly keeled, white, pink or purplish with darker keel; **Fil** white, glabrous; **Anth** ovate, 0.5 - 0.7 mm, purple; **NSc** cuneate with re-tuse or emarginate margin; **Fr** stellately patent.

A species of uncertain affinities, though it may be close to *S. hispanicum* and *S. steudelii* (both classified in Ser. *Glauco-rubens*).

S. ×brevierei Chassagne (Fl. Auvergne 1: 443, 1956). **T:** France, Puy de Dome (*Anonymus* s.n. [CLF]). – **D:** C and W France.

= *Sedum forsterianum* × *S. rupestre* ssp. *rupestre*. Intermediate between the parents; **L** semiterete, not conspicuously tufted; **Inf** drooping in bud, glabrous; **Bra** rudimentary, only subtending the **Fl** in the centre of the **Inf**; **Sep** ± 2.5 mm; **Pet** yellow, ± 6.5 mm, spreading; **Fil** yellow, glabrous. – *Cytology*: $2n = 104$.

S. brevifolium De Candolle (Nouv. Bull. Sci. Soc. Philom. Paris 1: 117, 1808). – **Lit:** Jalas & al. (1999: 104). **D:** SW Europe (Andorra, Spain, Portugal, France, Sardinia, Corsica), NW Africa (Morocco). **Fig. XXXIII.g**

= *Sedum dasyphyllum* ssp. *brevifolium* (De Candolle) Rouy & Camus (1901) = *Oreosedum brevifolium* (De Candolle) Grulich (1984); **incl.** *Sedum sphaericum* Lapeyrouse (1813); **incl.** *Sedum brevifolium* var. *induratum* Cosson (1873); **incl.** *Sedum brevifolium* var. *cineritium* Merino (1905) = *Sedum cineritium* (Merino) Merino (1909); **incl.** *Sedum brevifolium* var. *quinquefarium* Praeger (1921) = *Sedum quinquefarium* (Praeger) R. L. Evans (1983) (*nom. inval.*, Art. 33.2) = *Sedum brevifolium* fa. *quinquefarium* (Praeger) R. Stephenson (1994) (*nom. inval.*, Art. 33.2); **incl.** *Sedum brevifolium* var. *pottsii* Hort. Potts ex Praeger (1921) (*nom. inval.*, Art. 34.1a).

[1] Glabrous, often completely pruinose, perennial herbs with branching and rooting, trailing and apically ascending non-flowering shoots; **L** decussate or rarely alternate, usually densely packed, sessile, oblong to ovoid or (sub-) globose, to 1.5 - 5

mm, obtuse, terete, pruinose, glaucous or shiny dark green, often red; flowering **Br** simple, to 10 cm tall; **Inf** rather lax cymes with (1-) 2 (-3) cincinni; **Bra** 1 per **Fl**, small; **Ped** 2 - 4 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, equal, ovate, 1 - 1.5 mm, acute; **Pet** $\pm$ free, ovate-lanceolate, ± 4 mm, obtuse to apiculate, white or rarely pinkish, outside often reddish-green; **Fil** white; **Anth** red; **NSc** subquadrate, yellowish; **Sty** slender, 0.5 - 1 mm; **Fr** brown, erect; **Se** pear-shaped, bipapillate. – *Cytology*: $2n = 36$.

Thought to be related to *S. andegavense*, *S. candollei* and *S. pedicellatum* because of the testa ornamentation and flower structure ('t Hart 1991), but apparently quite distant from these species and closer to *S. atratum* ('t Hart & al. 1999).

S. brissemoretii Hamet (Bull. Soc. Bot. France 72: 77, 1925). **T:** Madeira (*Bornmiller* 641 [Weimar]). – **D:** N Madeira, 0 - 500 m. **I:** 't Hart (1999a).

[1] Glabrous perennial herbs, non-flowering shoots slender, branched, ascending or erect, basally somewhat woody, to 16 cm tall, young **Br** often mamillate, scabrous, turning reddish-brown; **L** alternate, sessile with a short spur, subovate, 2.5 - 8 mm, rounded, terete to subterete, green; flowering **Br** ascending or erect, to 8 cm, sparingly leafy; **Inf** few-flowered cymes with 2 - 3 few-flowered monochasial **Br**; **Bra** 2; **Fl** 5-merous, subsessile; **Sep** basally free, spurred, unequal, subovate, 3.5 - 5 mm, obtuse to rounded, semiterete, green; **Pet** basally connate for 0.6 mm, oblong-elliptic, 4.5 - 7 mm, acute, yellow; **Fil** yellow; **Anth** oblong, yellow; **NSc** broadly spatulate; **Sty** slender; **Fr** stellately patent, brown, with distinct lips along the suture; **Se** ovoid, brown, reticulate-papillose. – *Cytology*: $2n = 22$.

Closely resembling *S. nudum*, but differing by its habit, larger leaves and larger more showy flowers. In addition, *S. brissemoretii* differs in ecological preference (wet rocks exposed to the N). It belongs to the comparium of Ser. *Macaronesia* Fröderström. – [H. 't Hart]

S. bulbiferum Makino (Ill. Fl. Jap. 1(10): 107, t. 60, 1891). **T:** not located. – **D:** Japan (Honshu, Shikoku, Iheya, Okinawa, Kyushu), Taiwan (Nantou), Korea, SE China; shaded places, lowlands, to 1000 m. **I:** Tang & Huang (1989: 162); Tang & Huang (1993: 19).

= *Sedum alfredii* var. *bulbiferum* (Makino) Fröderström (1931).

[1] Annual or perennial herbs with erect or ascending stems, often branched from the base, producing bulbils in the **Ax** of the **L** and **Bra**, bulbils consisting of 1 - 3 pairs of small fleshy **Sc**-like **L**; **L** alternate, opposite at the stem base, ovate-spatulate to spatulate-oblongate or oblong, obtuse, sometimes mamillate towards the tip, spurred, 4 - 20 × 2 - 10 mm; flowering **Br** often branched, to 20 cm tall; **Inf** cymes with 1 - 3 cincinni, these often

forked; **Bra** L-like; **Fl** 5-merous, subsessile; **Sep** basally free, shortly spurred, unequal, broadly lanceolate to oblanceolate, (sub-) obtuse, mamillate, sometimes recurved at the tip, 2 - 6 × 0.5 - 2 mm; **Pet** free, lanceolate, shortly and narrowly mucronate, yellow, 3.5 - 5 mm; **Anth** orange-yellow; **NSc** spatulate, white to yellowish; **Sty** ± 1 mm; **Fr** very broad follicles, spreading; **Se** pale brown, reticulate-papillate. – *Cytology*: 2n = 38, ±56.

Ohwi (1965) included *S. subtile* var. *obovatum* in the synonymy here, whereas Makino (1914) treats it as a separate species, *S. obovatum*. The recently described *S. jinianum* is very similar.

S. burrito Moran (CSJA 49(6): 266-268, ill., 1977). **T**: Mexico, Veracruz (*Hutchison* 1328A [SD 97022]). – **D**: Mexico (Veracruz). **Fig. XXXIII.b**

[1] Glabrous perennial herbs with stems branching freely near the base, first erect, then pendent, glaucous-green, 50 cm long or more; **L** crowded, in 5 obvious spirals, elliptic, obtuse, turgid, subterete, bluish-glaucous, 12 - 16 × 6 - 9 mm, 5 - 7 mm thick; flowering **Br** pendent; **Inf** corymbs; **Ped** 8 - 12 mm, slightly thickened upwards; **Fl** 5-merous; **Sep** broadly sessile, connate, unequal, triangular-ovate, subacute to obtuse, 5 - 7 × 6 - 8 mm; **Pet** basally connate, ovate, narrowly rounded, subcucullate, mucronate, pink with deeper pink irregular lines, 7 - 8 mm; **Fil** pink; **Anth** light yellow; **NSc** broad, emarginate, deep pink. – *Cytology*: 2n = 69.

Closely related to *S. morganianum*.

S. caducum R. T. Clausen (CSJA 22(3): 86-89, ill., 1950). **T**: Mexico, Tamaulipas (*Clausen* 7370 [CU ?]). – **D**: Mexico (Tamaulipas); limestone, 600 m.

[1] Perennial herbs branching from the base, with decumbent papillose stems; **L** alternate, rhombic-ovate, obtuse, papillate-crenulate, subterete, marginally densely covered with red spots, caducuous, 7 - 22 × 4 - 12 mm; flowering **Br** erect; **Inf** few-flowered cymes; **Bra** oblong-elliptical, 2.5 - 4.5 mm; **Ped** 1 - 1.5 mm; **Fl** 5-merous (rarely 6-merous); **Sep** broadly sessile, oblong, obtuse, subterete, 3.5 - 4.5 × ± 1 mm, suberect; **Pet** basally connate, lanceolate, subacute, cucullate, ± 6 mm, white, first erect then spreading; **Fil** white; **Anth** yellow or red; **Sty** long; **NSc** reniform, broadly rounded, creamy white; **Se** reticulate. – *Cytology*: 2n = 128, 192.

S. caeruleum Linné (Mant. Pl. Altera, 241, 1771). **T**: LINN 595.3. – **D**: W Mediterranean (France (Corsica), Italy (Sardinia, Sicily), Malta), N Africa (Morocco, Algeria, Tunisia). **Fig. XXXIII.d**

≡ *Oreosedum caeruleum* (Linné) Grulich (1984); **incl.** *Sedum heptapetalum* Poirét (1789); **incl.** *Sedum coeruleum* Vahl (1791); **incl.** *Sedum azureum* Desfontaines (1798); **incl.** *Sedum caeruleum* var.

pusillum Maire (1937); **incl.** *Sedum caeruleum* fa. *eu-caeruleum* Maire (1937) (*nom. inval.*, Art. 26.1); **incl.** *Sedum caeruleum* fa. *glabrum* Maire (1977) (*nom. inval.*, Art. 36.1); **incl.** *Sedum caeruleum* fa. *puberulum* Maire (1977) (*nom. inval.*, Art. 36.1, 37.1).

[1] Glabrous or sparsely glandular-pubescent annuals, simple or much branched, erect, to 20 cm tall; **L** alternate, sessile, ovate to oblong or almost linear, 5 - 25 mm, obtuse or rounded, terete to semiterete, often shiny, green, often suffused with red; **Inf** lax cymes with 2 to many, sometimes forked (in large **Inf**) cincinni; **Bra** L-like to small; **Ped** 3 - 7 mm; **Fl** (5- to) 7- (to 9-) merous; **Sep** broadly sessile, basally connate, ovate, to 1 mm, obtuse; **Pet** free, oblong-lanceolate, 2 - 4 mm, obtuse, subapiculate, blue, pale blue or white (rarely pinkish); **Fil** white; **Anth** red, often dark; **NSc** minute, obovate, stipitate, white; **Fr** erect, greyish, ventrally papillate, 1- or 2- (to 3-) seeded; **Se** ovoid, dark brown, costate. – *Cytology*: 2n = 26, 28.

A very distinctive species, though rather variable with regard to flower colour and hairiness (see Maire (1977)). The chromosomes are very small and the variation in their numbers may indicate extensive dysploid rearrangements.

S. caeruleum and the closely related *S. maurum* form the the stem-groups of a lineage that gave rise to the "Macaronesian *Sempervivoideae*", i.e. *Aeonium*, *Aichryson* and *Monanthes*, together with the species of *Sedum* Ser. *Monanthoidea* and *S. Ser. Pubescens*.

S. caespitosum (Cavanilles) De Candolle (PSRV 3: 405, 1828). **T**: Spain (*Cavanilles* s.n. [MA 51799]). – **Lit**: Jalas & al. (1999: 108-109). **D**: SW, S and SE Europe (Portugal to Ukraine, Balkans), N Africa, W Turkey, N Syria, Iran; temporarily wet places, from sea-level to over 1000 m. **I**: Castroviejo (1997: 141).

≡ *Crassula caespitosa* Cavanilles (1791) ≡ *Sedum rubens* ssp. *caespitosum* (Cavanilles) Bonnier & Layens (s.a.) ≡ *Aithales caespitosa* (Cavanilles) Webb (1849); **incl.** *Tillaea rubra* Linné (1753) ≡ *Sedum rubrum* (Linné) Thellung (1912) (*nom. illeg.*, Art. 53.1); **incl.** *Crassula magnolii* De Candolle (1808) ≡ *Procrassula magnolii* (De Candolle) Grisebach (1843); **incl.** *Sedum deserti-hungarici* Simonkai (1890); **incl.** *Sedum rubrum* var. *louisii* J. Thiébaud & Gombault (1934) (*incorrect name*, Art. 11.4) ≡ *Sedum louisii* (J. Thiébaud & Gombault) Fröderström (1936).

[1] Small, almost completely glabrous annual herbs with erect or ascending, sometimes branched stems, 2 - 6 (-9) cm tall; **L** alternate, ovate or broadly elliptic to obovate, sessile with a very small spur, obtuse, terete or semiterete, 2.5 - 5 mm; **Inf** few-flowered cymes with 1 - 3 cincinni, sometimes 1-flowered; **Bra** 1 or 2 per **Fl**, L-like, 3 - 4 mm; **Ped** short; **Fl** 4- or 5-merous, with 4 or 5 **St**; **Sep**

broadly sessile, basally slightly connate, triangular, acute, ± 1 mm; **Pet** free, narrowly elliptic to lanceolate, acuminate, white with a green or red keel, sometimes reddish, 2.5 - 4 mm; **Fil** white; **Anth** red or yellowish; **NSc** spatulate, white; **Sty** short; **Fr** stellately patent, slender, brown; **Se** elliptic, pale brown, costate. – *Cytology*: $2n = 12, 24$.

S. calcaratum Rose (Bull. New York Bot. Gard. 3(9): 40, 1903). **T**: Mexico, Hidalgo (*Pringle* 8620 [US, ENCB]). – **D**: Mexico (Hidalgo). **I**: Fröderström (1936a: 129, t. 89).

[1] Glabrous perennial herbs with subnapiform **R**; **L** alternate, linear to linear-cylindrical, obtuse, shortly and bluntly spurred, terete, 5 - 12 mm; flowering **Br** erect, much branched, with $\pm$ purple stems; **Inf** elongated, secund; **Bra** oblanceolate to oblong, 3 - 4 mm; **Fl** 5-merous, shortly pedicellate; **Sep** basally free, shortly spurred, unequal, lanceolate to oblong, obtuse, 2 - 5 mm, green; **Pet** basally slightly connate, triangular-suboblong, obtuse to subobtuse, shortly and broadly mucronate, ± 5 mm, red; **Anth** reddish-brown; **NSc** linear, acuminate, reddish; **Fr** spreading to stellate, with very small to prominent lips along the ventral suture, reddish brown; **Se** lanceolate, reticulate.

S. calcicola Robinson & Greenman (Amer. J. Sci. ser. 3, 50: 150, 1895). – **D**: Mexico (San Luis Potosí); limestone. **I**: Fröderström (1936a: 40, t. 40).

$\equiv$ *Altamiranoa calcicola* (Robinson & Greenman) Rose (1903) $\equiv$ *Villadia calcicola* (Robinson & Greenman) H. Jacobsen (1958).

[1] Glabrous perennial subshrubs with few-branched, slender, first procumbent and then erect stems; **L** scattered, alternate, oblanceolate or somewhat broader, subacute, very shortly spurred, mamillate, subterete, 3 - 16 mm, spreading; flowering **Br** erect, sometimes glaucous, the older ones roughened; **Inf** fastigiate-racemose; **Bra** oblanceolate, mamillate, subacute, ± 4 mm; **Fl** 5-merous, subsessile; **Sep** basally free, slightly unequal, oblong, subobtuse, 3 - 3.5 mm; **Pet** basally connate up to 1 mm, broadly lanceolate, subacute, narrowly mucronate, greenish-yellow, 6 - 7 mm; **NSc** subquadrate-ovate, slightly emarginate; **Sty** very long, ± 6 mm; **Fr** erect.

Related with *S. acropetalum*, *S. gypsophilum* and *S. lenophylloides*.

S. callichroum Boissier (Diagn. Pl. Orient. Ser. 1, 6: 56, 1845). **T**: Iran (*Kotschy & Hohenacker* 743 [C, G-BOIS, W]). – **D**: Iran.

$\equiv$ *Oreosedum callichroum* (Boissier) Grulich (1984); **incl.** *Sedum lineare* Pau (1918) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum sublineare* Fröderström (1932) (*nom. inval.*, Art. 34.1b).

[2] Completely glabrous annual herbs with small slender simple erect stems, to 4 cm tall; **L** alternate,

sessile, semiterete, oblong to ovate, 1 - 3.5 mm long, obtuse; **Inf** few-flowered cymes; **Ped** filiform, 0.5 - 3.5 mm; **Fl** 5-merous; **Sep** broadly sessile, broadly ovate, obtuse, ± 1 mm; **Pet** oblong-lanceolate to subovate, acuminate, ± 3 mm, white or pinkish, with a red keel; **Anth** red; **NSc** oblong-square to spatulate, emarginate; **Sty** short; **Fr** erect, 3- to 5-seeded; **Se** oblong, costate.

Ephemeral, little-known Iranian endemic probably related to *S. kotschyianum*.

S. candollei Hamet (Candollea 4: 26, 1929). **T**: France, Pyrénées (*De Candolle* s.n. [G-DC]). – **D**: SW Europe (France [Pyrénées], Spain, Portugal; on silicate, 1500 - 3000 m. **I**: Castroviejo (1997: 138, t. 38: a-d).

incl. *Cotyledon sedoides* De Candolle (1808) $\equiv$ *Umbilicus sedoides* (De Candolle) De Candolle (1828) $\equiv$ *Sedum sedoides* (De Candolle) Rothmaler (1935) (*nom. illeg.*, Art. 53.1) $\equiv$ *Mucizonia sedoides* (De Candolle) D. A. Webb (1961); **incl.** *Cotyledon sediformis* Lapeyrouse (1813) (*nom. illeg.*, Art. 52.1); **incl.** *Umbilicus sessilis* Dulac (1867) (*nom. illeg.*, Art. 52.1); **incl.** *Cotyledon ramosissima* Rothmaler (1934) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum sedoides* ssp. *ramosissimum* Rothmaler (1935) (*incorrect name*, Art. 11.4); **incl.** *Sedum candolleianum* Hamet ex G. López (1995).

[1] Glabrous small perennial or biennial herbs forming small mats or tufts of much-branched non-flowering shoots; **L** alternate, densely imbricate, sessile, oblong, 2.5 - 5 $\times$ 1 - 1.5 mm, obtuse, dark green but more often bright red; flowering **Br** ascending or erect, usually simple, densely leafy, to 7 cm tall; **Inf** dense few-flowered corymbose cymes; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, basally connate, lanceolate, 2.5 - 4 mm, acute; **Pet** basally connate for 2 - 2.5 mm, oblong-ovate, 5 - 7 mm, acute or acuminate, pinkish-white to pink or purple; **Fil** white to purple; **Anth** red; **Fr** erect, brown; **Se** pear-shaped, dark brown, bipapillose. – *Cytology*: $2n = 22, 33$.

Closely related to *S. andegavense* and *S. pedicellatum* ('t Hart & al. 1999). The 3 species form a comparium and have been classified in Ser. *Pedicellata* 't Hart.

S. carnegiei Hamet (Ann. Carnegie Mus. 8: 419, 1913). **T**: Tibet (*Walton* s.n. [CM]). – **D**: Tibet (Lhasa region).

[?] Probably perennial herbs with small globose tubers; **L** alternate, densely imbricate, broadly ovate or ovate-oblong to oblong, obtuse to rounded, shortly spurred, $\pm 3 \times 1.5 - 2.5$ mm; flowering **Br** simple, usually slender, to 4.5 cm tall; **Inf** simple few-flowered spikes; **Bra** L-like; **Ped** to 0.8 mm; **Fl** 5-merous; **Sep** broadly sessile, ovate to ovate-oblong, obtuse, 2.1 - 3.4 $\times$ ± 1 mm; **Pet** basally slightly connate, oblong, obtuse, slightly widened basally, colour not recorded, 2.1 - 3.2 mm; **NSc** sub-

obovate, rounded, somewhat wider than long; **Sty** rather short; **Fr** divergent.

Of uncertain affinities. In respect to its origin, the presence of tubers and the shape of the leaves, it could be related to either *Hylotelephium* or *Rhodiola* rather than *Sedum* s.str.

S. caroli-henrici Kit Tan (Notes Roy. Bot. Gard. Edinburgh 42(1): 65, ill. (p. 62), 1984). **T:** Turkey, Mus (*Rechinger* 53924 [E, W]). – **D:** NE Turkey; rocky volcanic slopes, 1500 m; known from the type collection only.

[1] Small annual herbs; stems erect, simple, 5 - 10 cm, without sterile **Br**; **L** alternate, oblong-linear, 3.5 - 10 × 0.4 mm, semiterete, glabrous; **Inf** corymbose, 14- to 25-flowered; **Fl** 5-merous, pedicellate; **Sep** narrowly triangular to lanceolate, 1.5 × 0.5 - 0.7 mm, ± acute; **Pet** lanceolate, lemon-yellow, ± 6 mm, 4× as long as the **Sep**; **Fr** glabrous, erect.

Closely related to *S. nanum* but with more numerous flowers per inflorescence and longer petals. 't Hart & Alpınar (2000: 132) treat the taxon as synonym of *S. assyriacum*. – [U. Eggli]

S. catorce G. L. Nesom (Phytologia 79(4): 264, 1996). **T:** Mexico, San Luis Potosí (*Clausen* 772028 [CU, ENCB?, MEXU?]). – **D:** Mexico (San Luis Potosí: near Real de Catorce); quartzite cliff, 2620 m; known from the type collection only.

Incl. *Sedum parvum* ssp. *dendroides* R. T. Clausen (1978).

[1] Erect to semi-erect (rarely somewhat pendent) perennials, 10 - 25 cm tall, slightly glaucous; **R** probably tuberous; stems strongly woody, reddish, minutely papillate, not shiny; **L** all of similar size, lanceolate-oblong, flat but with swollen base, (3-) 3.5 - 5 × 1.3 - 2 mm, dark green with prominent white margins, venation usually clearly visible; flowering **Br** and **Fl** as in *S. parvum*; **Pet** erect to spreading or reflexed, 6 - 7 mm, yellow.

Another member of the *S. parvum* group (Nesom & Turner 1996). – [U. Eggli]

S. celatum Fröderström (Acta Horti Gothob. 7(Ap-pendix): 114-115, figs. 938-948, t. 64, 1932). **T:** China, Gansu (*Hummel* 4111 [S]). – **D:** China (S Gansu, E Qinghai); slopes, 2900 - 4200 m.

[1] Probably annual herbs; **L** alternate, lanceolate to subovate, acuminate, spurred, 5 - 7 mm; flowering **Br** prostrate or creeping to suberect, much branched from the base, 3 - 8 cm tall; **Inf** lax few-flowered corymbs; **Bra** broadly linear, acuminate, 2 - 2.5 mm; **Fl** 5-merous; **Sep** broadly sessile, subovate, long acuminate, 3 - 4 mm; **Pet** free or slightly connate, lanceolate to oblong, acute, yellow, ± 4 mm; **NSc** stipitate, widening towards the tip, slightly emarginate; **Sty** short; **Fr** few-seeded; **Se** ovoid, reticulate-papillose.

S. celatum fa. **calcaratum** K. T. Fu (Bull. Bot. Res., Harbin 7(1): 69, 1987). **T:** China, Qinghai (*Hao* 1025 [PE]). – **D:** China (Qinghai); 3600 - 4000 m.

Incl. *Sedum wuiianum* K. S. Hao (1938).

[1] **Sep** conspicuously spurred.

S. celatum fa. **celatum** – **D:** China (S Gansu); ± 3000 m.

[1] **Sep** without spur or indistinctly spurred.

S. celiae Hamet (Bull. Acad. Int. Géogr. Bot. 23: 67-68, 1913). **T:** China, Yunnan (*Maire* 6735 [Herb. Diels [B ?]]). – **D:** China (NW Yunnan); rocks in valleys, 2600 - 3000 m. **I:** Fröderström (1931: 52, t. 32); Byalt (2001a: 32).

Incl. *Sedum bonapartei* Hamet (s.a.) (*nom. inval.*, Art. 32.1c).

[1] Perennial herbs with creeping and rooting stolons; **L** alternate, imbricate, narrowly triangular, acuminate, 3 - 8 mm, with a trilobate obtuse spur; flowering **Br** ascending or erect, much branched, 3 - 9 cm tall; **Inf** lax corymbs or rarely 1-flowered; **Fl** 5-merous; **Sep** basally free, semilanceolate, acuminate, 3.5 - 6.5 mm; **Pet** basally connate, broadly lanceolate, shortly mucronate, yellowish, 4 - 6 mm; **NSc** broadly linear-spatulate, obtuse or emarginate; **Se** oblong, reticulate.

S. cepaea Linné (Spec. Pl. [ed. 1], 431, 1753). **T:** BM [lecto: Herb. Clifford p. 177, *Sedum* 5]. – **Lit:** Jalas & al. (1999: 119). **D:** C and S Europe (excl. Iberian Peninsula), W Turkey, N Africa; shady places, usually on limestone, to 1500 m. **I:** Lippert (1995: 111).

Incl. *Cepaea caesalpini* Fourreau (s.a.); **incl.** *Sedum paniculatum* Lamarck (1778); **incl.** *Sedum galioides* Pourret (1785) ≡ *Sedum cepaea* var. *galioides* (Pourret) Rouy (1901); **incl.** *Sedum spathulatum* Waldstein & Kitaibel (1805); **incl.** *Sedum tetraphyllum* Sibthorp & Smith (1809); **incl.** *Sedum calabrum* Tenore (1831); **incl.** *Sedum strictum* K. Koch (1847); **incl.** *Sedum heptapetalum* Raulin (1869) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum amani* Post (1893); **incl.** *Sedum cepaea* var. *gracilescens* Maire & Weiller (1939); **incl.** *Sedum schwarzii* Werdermann (1939).

[1] Glandular-pubescent herbs, annual or biennial (usually monocarpic but perhaps sometimes perennial), forming flat **Ros**; **L** in whorls of 4, broadly elliptic to obovate or oblanceolate-spatulate, petiole or subsessile, flat, rounded, sparsely pubescent or glabrous, often reddish, to 3 cm long; flowering **Br** erect, simple, rarely branched from the base, with alternate pubescent **L**; **Inf** diffuse or dense panicles, 15 - 40 cm, composed of numerous, usually forked and few-flowered cincinni; **Bra** small; **Ped** (1-) 3 - 5 mm; **Fl** 5-merous; **Sep** broadly sessile, slightly connate at the base, lanceolate-elliptic, subacute, ± 2 mm; **Pet** free or basally slightly connate,

lanceolate or ovate, aristate, white, rarely pinkish, often with a red pubescent keel, ± 5 mm; **Fil** white; **Anth** red, rarely yellow; **NSc** triangular-cuneate to spatulate, dentate, yellowish; **Fr** erect, longitudinally grooved, whitish; **Se** ovoid, pale brown, costate. – *Cytology*: $2n = 20, 22, 44$.

All the Anatolian and some Greek plants have the dysploid chromosome number $2n = 20$. A form with dense narrow inflorescences is also quite common in this region, but the two characters are not correlated.

S. cepaea is the type of Ser. *Cepaea*. *S. lampusae*, *S. microstachyum* and *S. cyprium*, also classified in this section, are similar. The occurrence of *S. cepaea* on Crete was recently reported by Deschâtres & Greuter (2001).

S. chauveaudii Hamet (Notul. Syst. (Paris) 1: 137-139, 1910). **T**: China, Yunnan (*Delavay* s.n. [P]). – **D**: Nepal, China (NW Guizhou, SW Sichuan, E Yunnan); rocks in forests, shady banks, sunny slopes, rock crevices in alpine zones; 1700 - 3800 m. **I**: Fröderström (1931: 54, t. 34); Fu & Fu (1984: t. 27).

Incl. *Sedum chauveaudii* var. *chauveaudii*; **incl.** *Sedum margaritae* Hamet (1910) $\equiv$ *Sedum chauveaudii* var. *margaritae* (Hamet) Fröderström (1929); **incl.** *Sedum triphyllum* Praeger (1921) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum chauveaudii* var. *genuinum* Hamet (1929) (*nom. inval.*, Art. 24.3).

[1] Perennial herbs with long and slender rooting stems, 3 - 10 cm long; **L** in whorls of 3 or sometimes alternate, persistent below, spatulate appearing almost petiolate, subobtuse, with a narrow, obtuse or sometimes bifid spur, mamillate, 6 - 20 mm; flowering **Br** ascending, papillose towards the tip, 10 - 20 cm tall; **Inf** broad somewhat lax corymbs; **Fl** 5-merous; **Sep** basally free, shortly spurred, unequal, broadly linear-subspatulate, rounded, mamillate, 6.5 - 8 mm; **Pet** basally connate for up to 1.5 mm, lanceolate to oblong, submucronate, narrowing towards the base, yellowish, 8 - 12 mm; **NSc** square, slightly widening towards the tip; **Sty** short; **Fr** erect or subdivergent, sometimes with narrow lips along the suture; **Se** ovate, reticulate-papillose.

S. margaritae differs by its alternate leaves and more erect follicles. Fröderström (1930) and Fu & Fu (1984) classified it as a variety of *S. chauveaudii*, but the significance of these characters seems to be limited even for a distinction at varietal level.

S. chihuahuense S. Watson (Proc. Amer. Acad. Arts 23: 273, 1888). **T**: Mexico, Chihuahua (*Pringle* 1240 [US ?, NY]). – **D**: Mexico (Chihuahua: Sierra Madre Occidental). **I**: Fröderström (1936a: 124, t. 84).

$\equiv$ *Altamiranoa chihuahuensis* (S. Watson) Rose (1903) $\equiv$ *Villadia chihuahuensis* (S. Watson) H. Jacobsen (1958).

[1] Perennial herbs with tuberous **R** and slender

erect stems, simple below, branching above, 9 - 12 cm tall; **L** alternate, lanceolate to oblong, obtuse, broadly spurred, 2 - 5 mm; flowering **Br** erect; **Inf** spreading cymes with dichotomously forked **Br**; **Fl** 5-merous, subsessile; **Sep** basally free, rather long and narrowly spurred, unequal, oblong, obtuse, thin, 4 - 5 mm; **Pet** basally slightly connate, broadly linear-oblong, obtuse, very thin and wavy in the upper part, white, ± 6 mm; **NSc** stipitate-spatulate, broad, obtuse; **Se** ovoid, reticulate-papillose.

S. chingtungense K. T. Fu (Acta Phytotax. Sin. 12(1): 67, t. 10: 1-9, 1974). **T**: China, Yunnan (*Hsu* 3574 [KUN]). – **D**: China (WC Yunnan); near wells, ± 2100 m. **I**: Fu & Fu (1984: t. 26).

[1] Usually smallish erect or procumbent annual herbs to 15 cm tall; **L** alternate, few, sublyrate, obtuse, obtusely spurred, 4 - 8 mm; **Inf** dense few-flowered cymes, sometimes with 1 **Fl** only; **Fl** 5-merous; **Sep** basally free, shortly spurred, narrowly oblong to oblanceolate-oblong, obtuse, $4.5 - 6 \times \pm 1.5$ mm; **Pet** broadly sessile, basally slightly connate, subovate, obtuse, narrowing towards the base, yellow, ± 6 mm; **NSc** linear, broader towards the tip, emarginate; **Sty** short; **Fr** suberect or divergent; **Se** obovate, reticulate-papillose.

S. chloropetalum R. T. Clausen (CSJA 20: 53-54, ill., 1948). **T**: Mexico, Oaxaca (*Clausen* C45-50 [CU]). – **D**: Mexico (Oaxaca). **Fig.** XXXIII.c

[1] Perennial subshrubs with spreading grey papillose stems, to 1 m tall; **L** alternate, rounded, broadly spurred, yellowish green, sometimes purple along the apical margins, 3 - $29 \times 2.5 - 8$ mm; **Inf** cymes with 2 **Br**, which continue to elongate after anthesis and form new leafy flowering **Br**; **Bra** spatulate to elliptic-oblong, 4 - 11 mm; **Fl** 5-merous, sessile or pedicellate; **Sep** unequal, oblong, obtuse, $2.5 - 6.5 \times 1 - 2.5$ mm; **Pet** elliptic-lanceolate, acute, canaliculate, yellowish-green with purple stripes and purple at the base, 5 - 6 mm; **Fil** deep red; **Anth** red; **NSc** transversely oblong, yellow. – *Cytology*: $2n = 58$.

S. chrysicaulum J. A. McDonald (Sida 14(3): 315-319, ill., 1991). **T**: Mexico, Nuevo León (*McDonald & Mayfield* 2556 [TEX, MEXU, NY, UAT]). – **Lit**: Nesom & Turner (1996). **D**: Mexico (C-S Nuevo León, SE Coahuila); subalpine to alpine meadows, 3400 - 3800 m.

[1] Glabrous perennial herbs with smooth ascending golden-shiny stems, branched from the base; **L** narrowly oblanceolate-oblong, obtuse, flat, 5 - 6 mm long near the stem base, 7 - 10 mm long in the upper parts, 2 - 3 mm wide, green with prominent red dots; flowering **Br** erect, 5 - 9 cm; **Inf** compact few-flowered cymes; **Fl** 5-merous; **Sep** broadly lanceolate, coriaceous, 4 - $5 \times 1.5 - 2$ mm, pale green; **Pet** narrowly elliptic or lanceolate, 5 - 8 mm, yellow with prominent short longitudinal red stripes,

erect; **Fil** yellow; **Anth** yellow; **Sty** ± 2 mm; **Fr** widely spreading, 7 - 9 mm, reddish; **Se** narrowly ellipsoid, $0.7 - 1 \times \pm 0.5$ mm wide, brown, glossy, densely reticulate-papillose.

Another member of the *S. parvum* group (Nesom & Turner 1996). – [H. 't Hart, B. Bleij & U. Eggli]

S. chuhsingense K. T. Fu (Bull. Bot. Res., Harbin 7(1): 68-70, ill., 1987). **T:** China, Yunnan (*Xie* 124 [HNWP]). – **D:** China (C Yunnan). **I:** Fu (1987).

[1] Perennial herbs; **L** in whorls of 4, linear-spatulate, acute, with rounded or sometimes lobed spur, $4 - 16 \times 1.5 - 2$ mm; flowering **Br** erect, fleshy, with quadrangular nodes, 8 - 10 cm tall; **Inf** many-flowered cymes with up to 4 cincinni; **Fl** 5-merous, sessile; **Sep** broadly sessile, basally slightly connate, broadly ovate to semi-oblong, $\pm 1.5 \times 1.2$ mm; **Pet** lanceolate, shortly mucronate, slightly recurved at the tip; **NSc** oblong-spatulate, retuse; **Sty** long; **Fr** suberect; **Se** ovate.

Resembling the species of *Ser. Japonica* and *S. anhuiense* in habit.

S. churchillianum Robyns & Boutique (Bull. Jard. Bot. État 17: 313-315, ill., 1945). **T:** Zaïre (*Bequaert* 4511 [BR]). – **D:** E Africa (Ethiopia, Uganda, Zaïre); terrestrial or epiphytic in upland heath and moorland, 3000 - 3450 m.

Incl. *Sedum erlangerianum* Engler (1907).

[2] Glabrous subshrubs with distinctly woody, erect or decumbent, sparsely branched stems to 60 cm tall; **L** in whorls of 3, subsessile, oblong-elliptic to oblong-ovate, $15 - 30 \times 7 - 14$ mm, obtuse, flat; **Inf** many-flowered corymbose cymes; **Bra** L-like but smaller; **Ped** 7 - 13 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate for 1 mm, triangular, 4 - 5 mm, acute; **Pet** free, oblong-lanceolate, $10 - 15 \times 4 - 5$ mm, acute, yellow; **Fil** ± 10 mm, yellow; **Sty** recurved, 2.5 - 3 mm; **NSc** broad, retuse; **Fr** erect; **Se** oblong, brown, costate.

Closely related to *S. epidendrum* and *S. mooneyi*. According to the description, *S. erlangerianum* (here tentatively included as synonym, but having priority over *S. churchillianum*) is very similar to *S. churchillianum*, apart from its shorter pedicels, which are only 3 - 4 mm. However, the type collection of *S. erlangerianum* from Ladjö, Bale Region, Ethiopia, has been destroyed and no other authentic material is known to exist. More recent collections from Ethiopia (Bale, Shewa and Sidamo Regions) have all been identified as *S. churchillianum* by Gilbert (1985) and Wickens (1987).

S. cilicicum Kit Tan & Vural (Notes Roy. Bot. Gard. Edinburgh 42(1): 65, 1984). **T:** Turkey, Konya (*Vural* 614 [ANK]). – **D:** S Turkey (Cilician Taurus); open scrub, ± 1100 m.

[1] Annual herbs, completely glabrous and tinged reddish-pink; stems erect, simple, 6 - 9 cm, without sterile **Br**; **L** alternate, sessile, well separated along

the axis, narrowly ovate, 3 - 4 mm, subterete and fleshy, obtuse, spurred; **Inf** 8- to 9-branched cymes, **Br** appearing spicate, 5- to 9-flowered; **Fl** 5-merous, sessile; **Sep** ovate, 1.8 - 2 mm, obtuse; **Pet** ovate-lanceolate, 2.6 - 4 mm, white with pink mid-vein, acute; **St** 5, alternating with the **Pet**; **Fr** glabrous, erect-patent, 4- to 5-seeded; **Se** pear-shaped, 1 mm, pale brown.

Related to the widespread *S. litoreum*, from which it differs in smaller leaves, more richly flowered inflorescences, petal colour, and ecologically. – [U. Eggli]

S. clausenii Pérez-Calix (Acta Bot. Mex. 43: 1-5, ill., 1998). **T:** Mexico, Guanajuato (*Pérez-Calix & Carranza* 3615 [IEB, CHAPA, ENCB, MEXU]). – **D:** Mexico (NE Guanajuato, S San Luis Potosí); oak-pine forests, on steep igneous rock walls, 1700 - 2300 m.

[1] Perennial dwarf herbs to 15 cm tall; stems procumbent to pendent, glabrous, sterile **Br** very short and compact at the base of fertile **Br**; **L** alternate, congested and densely imbricate, spatulate, suborbicular to broadly ovate, $2 - 3.5 \times 2 - 3$ mm, rounded, those of the upper **Br** parts with a slightly petiole-like base, those of the upper parts of flowering **Br** larger and to $6.5 - 16.5 \times 4.5 - 5$ mm; **Inf** terminal cymes; **Ped** ± 6 mm; **Fl** 5-merous; **Sep** lanceolate, slightly unequal in size, pale green; **Cl** 8 mm $\varnothing$, bright yellow; **Pet** free, elliptic, $4 \times 1.5 - 2$ mm; **NSc** almost square; **Ca** erect, basally slightly fused; **Se** 0.3 mm, coffee-brown.

Compared with *S. grandipetalum* and *S. greggii* in the protologue. It differs from both by the more petiole-like leaf bases. – [U. Eggli]

S. clavatum R. T. Clausen (Sedum North Amer., 563, 1975). **T:** Mexico, México (*Clausen* TMV-T-Tis 1 [CU]). – **D:** C Mexico; known from the type locality only, cliffs of andesite. **I:** Clausen (1959: 102, as *Sedum* sp.).

[1] Perennial subshrubs, stems much-branched, glaucous, ± 20 cm tall; **L** alternate, clavate, elliptic-oblongate or obovate, obtuse, shortly spurred, upcurved, glaucous, pale green, sometimes with red mucronate tip, $13 - 63 \times 10 - 29$ mm; flowering **Br** erect, axillary; **Inf** pleiochasial cymes; **Ped** 3.6 - 6.5 mm; **Fl** 5-merous; **Sep** basally connate, very unequal, clavate, oblongate-oblong, rounded, glaucous, pale green, $5 - 8 \times 1.6 - 4.2$ mm, erect; **Pet** elliptic, acute or obtuse, minutely mucronate, carinate, white, ± 7 mm, spreading, slightly upcurved; **Anth** dark red; **NSc** reniform or subquadrate, truncate or emarginate, white. – *Cytology*: $2n = 66$.

S. clavifolium Rose (CUSNH 13(9): 297, 1911). **T:** Mexico, México (*Purpus* 1681 [US 399592]). – **D:** C Mexico; alpine vegetation, ± 3700 m. **I:** Fröderström (1936a: 59, t. 37); Clausen (1959: 209).

[1] Perennial herbs with branched rhizomes with

Sc-like **L** and terminal caespitose **Ros**; **L** alternate, spatulate or oblanceolate, petiolate, rounded, broadened at the base and amplexicaul, 4.7 - 34 × 0.9 - 5 mm; flowering **Br** ascending, to 14 cm; **Inf** cymes with monochasial **Br**; **Ped** ± 3.5 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, unequal, clavate-oblanceolate or oblong, obtuse, green speckled with red, 2.4 - 7 × 1.1 - 3 mm; **Pet** free, ovate, mucronate, greenish streaked with red, ± 3 mm, first spreading, then recurved; **Anth** yellow or orange; **NSc** conspicuous, to 1.8 mm, subquadrate, tip lacerate, with 2 prominent teeth, dark red, finely speckled with yellow; **Fr** erect, with small lips along the ventral suture; **Se** ellipsoid-oblong, yellow-brown, reticulate. – *Cytology*: 2n = 68 - 76.

S. cockerellii Britton (Bull. New York Bot. Gard. 3(9): 41-42, 1903). **T**: USA, New Mexico (*Cockerell* s.n. [US, NY]). – **D**: S USA (New Mexico), N Mexico (Chihuahua); shallow soils preferably in shade, 1600 - 3200 m. **I**: Fröderström (1936a: 51, t. 26); Clausen (1975: 189). **Fig. XXXIII.e**

≡ *Cockerellia cockerellii* (Britton) A. Löve & D. Löve (1985); **incl.** *Sedum puberulum* S. Watson (1888) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum wootonii* Britton (1903); **incl.** *Sedum anomioisepalum* Fröderström (1936).

[1] Glabrous small perennial tufted herbs with short **R**stocks bearing tiny **Ros**; **L** alternate, obovate or oblong-spatulate, broadly rounded to obtuse, flat, spurred, sessile, 3 - 5.8 × 1.6 - 3.3 mm, papillose, sometimes glaucous, green or yellow-green; flowering **Br** erect, 5.6 - 9.1 cm, sometimes papillose upwards; **Inf** cymes with 2 or 3 (-4) **Br**; **Bra** **L**-like but smaller; **Ped** 1 - 3.5 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, unequal, lanceolate-linear or clavate-oblong, papillose, acute or obtuse, 4.7 - 11.9 × 1.4 - 2.6 mm, yellow-green to green; **Pet** free, rarely slightly connate, lanceolate-elliptic, obtuse and with a minute mucronate appendage, white, streaked with pink, ± 7 mm; **Fil** white; **Anth** brown; **NSc** square, truncate, emarginate, yellow or creamy-white; **Fr** erect, pale brown, with divergent beaks; **Se** elliptically pear-shaped, reddish-brown, reticulate or reticulate-papillose. – *Cytology*: 2n = 28, 30, 32, (34), 58, 64.

The synonymization of *S. wootonii*, which is based on a composite collection also embracing specimens of *S. wrightii*, follows Clausen (1975: 198). – [H. 't Hart, B. Bleij & U. Eggli]

S. commixtum Moran & Hutchison (CSJA 52(4): 159-163, ill., 1980). **T**: Mexico, Oaxaca (*MacDougal* B.188 [UC 1175225, SD]). – **D**: Mexico (Oaxaca); 2600 - 3000 m. **Fig. XXXIII.h**

[1] Glabrous perennial glaucous subshrubs, at times trailing from cliffs, with several terete stems to ± 3 mm Ø, first blue-glaucous, later purplish-red or brownish, ± 30 cm long with lax **Ros**; **L** alternate, obovate-spatulate, rounded to broadly obtuse,

faintly apiculate, flattened or slightly subterete, blue-glaucous, 20 - 30 × 11 - 17 mm, shorter but wider on flowering **Br**, spreading; flowering **Br** erect to slightly ascending, 30 - 50 cm, with some lateral shoots below, axillary; **Inf** compact thyrses with 3 - 4 **Br**; **Fl** 5-merous, subsessile; **Sep** unequal, ovate, narrowly rounded, upcurved, subappressed, subterete, 4 - 6 mm, erect; **Cl** urceolate; **Pet** connate, ovate, acute, bluntly mucronate, 5 - 6 mm, recurved; **Fil** reddish above; **Anth** dull yellow, flecked with red; **Sty** ± 1.5 mm; **NSc** truncate, yellowish. – *Cytology*: 2n = 68.

S. compactum Rose (CUSNH 13(9): 297, pl. 53, 1911). **T**: Mexico, Oaxaca (*Purpus* s.n. [US 574880]). – **D**: Mexico (Oaxaca); rocks, 2100 - 2400 m.

[1] Tiny creeping perennial herbs with small tufted **Br** and terminal compact **Ros**, forming dense moss-like carpets; **L** closely imbricate, alternate, narrowly oblong, obtuse, sometimes spurred, flattened, 3 - 5 mm, glabrous, fleshy, green; flowering **Br** ascending or erect, 3 - 4 cm; **Inf** terminal solitary **Fl**; **Bra** oblong, 2 - 3 mm; **Fl** 5-merous, sessile; **Sep** broadly sessile, basally free, slightly unequal, broadly obovate to orbicular, shortly apiculate, 2 - 3 mm; **Pet** basally slightly connate, broadly ovate, subobtuse, submucronate, ± 4 mm, white; **NSc** broader than long, almost flat; **Se** ovoid, reticulate-papillose. – *Cytology*: 2n = 120.

S. compressum Rose (CUSNH 12(10): 440, t. 80, 1909). **T**: Mexico, Tamaulipas (*Palmer* s.n. [US 573870]). – **D**: Mexico (Tamaulipas); 300 m. **I**: Fröderström (1936a: t. 3-4). **Fig. XXXIV.a**

[1] Glabrous perennial herbs or subshrubs, ± prostrate, rooting at the nodes, 15 - 20 cm tall; **L** closely set, alternate, spatulate to oblanceolate, ovate, acute, flat, 25 - 30 × 10 - 12 mm, glaucous, spreading; flowering **Br** erect or ascending; **Inf** paniculate cymes of 2 or 3 racemes; **Fl** 5-merous, subsessile; **Sep** broadly sessile, shortly spurred, slightly unequal, ovate to lanceolate, subacute, 4 - 6 mm; **Pet** basally free, lanceolate to oblong, acute, narrowly mucronate, bright yellow, ± 7 mm, spreading; **NSc** subspatulate-quadrate, slightly emarginate, small, flat; **Sty** rather long; **Fr** suberect to divergent, subovate, with lips along the ventral suture; **Se** subovoid, reticulate-papillose.

S. concarpum Fröderström (J. Washington Acad. Sci. 25: 122, 1935). **T**: China, Yunnan (*Rock* 5826 [US]). – **D**: China (SW Hubei, SW Yunnan); alpine meadows, 2800 - 3400 m. **I**: Fröderström (1936a: 166, t. 113).

Incl. *Sedum concarpum* var. *hupehense* S. H. Fu (1965).

[1] Perennial herbs with decumbent and rooting densely leafy shoots, 3 - 5 cm long; **L** suborbicular or obovate, obtuse or rounded, long petiolate, ma-

millate, 5 - 25 mm; flowering **Br** to 9 cm tall; **Inf** dense corymbs, partly covered by the uppermost **L**; **Bra** **L**-like; **Fl** 5-merous; **Sep** broadly sessile, oblanceolate, subobtusate, mamillate at the tip, ± 5 mm; **Pet** free at the base, lanceolate, obtuse, yellow, 7 - 8 mm; **Sty** long; **NSc** linear-subspatulate, rounded, thick, reddish; **Fr** erect, connate for 3 mm; **Se** subovoid, reticulate.

The var. *hupehense* is provisionally placed in the synonymy. – [H. 't Hart, B. Bleij & U. Eggli]

S. confertiflorum Boissier (Diagn. Pl. Orient. 1(3): 15, 1843). **T:** K. – **D:** NE Greece incl. East Aegean Islands, Turkey (W and C Anatolia); lava rubble and rocks, to 900 m.

[1] Minute annual herbs 2 - 8 (-10) cm tall, glabrous, erect; stems simple or branched, becoming thicker below the **Inf**; **L** oblong, (semi-) terete, alternate, imbricate, 4 - 6 (-10) mm; **Inf** corymbose, very congested, with (5-) 10 - 20 subsessile **Fl**; **Fl** 5-merous; **Sep** connate for $\frac{1}{2}$ - $\frac{2}{3}$ of their length, 1 - 1.5 mm, obtuse, glandular-papillose; **Pet** white, 3 - 4 mm; **Ca** glabrous, erect, glandular-papillose; **Sty** fairly long.

S. sorgerae has similarly connate sepals and is placed here in the synonymy by 't Hart & Alpınar (2000: 132). – [U. Eggli]

S. confusum Hemsley (Diagn. Pl. Nov. Mexic. 10, 1878). – **D:** Mexico; known from cultivation only.

[1] Perennial subshrubs to 60 cm tall; **L** alternate, spatulate, rounded, shortly spurred, rarely emarginate, lustrous green, 20 - 60 $\times$ 12 - 17 mm; flowering **Br** erect or ascending, axillary, ± 5 cm; **Inf** dense cymes or panicles, (loosely corymbose, cf. Fröderström (1936a: 9)). **Fl** 5-merous, subsessile; **Sep** basally slightly connate, shortly spurred, unequal, ovate, obtuse to acute, green, $\pm 1.2 \times 1$ mm, erect; **Pet** free, oblong to lanceolate, acute to subobtusate, mucronate, orange-yellow, ± 5.5 mm; **NSc** subspatulate-quadrate, whitish; **Fr** widely divergent; **Se** subovoid, reticulate.

Related to *S. aoikon* and often confused with it (Clausen 1959; Clausen 1975: 561).

S. conzattii Rose (Bull. New York Bot. Gard. 3(9): 42-43, 1903). **T:** Mexico, Oaxaca (*Conzatti & Gonzalez* 495 [US]). – **D:** Mexico (Oaxaca); ± 2300 m. **I:** Fröderström (1936a: 30, t. 19).

[1] Few-branched perennial herbs or subshrubs with slender suberect stems, densely papillose in the upper part, 3 - 40 cm tall; **L** alternate, subspatulate-oblong, rounded or obtuse, mamillate, 10 - 30 mm; flowering **Br** erect; **Inf** short panicles or lax corymbs; **Bra** lanceolate, obtuse, papillose; **Fl** 5-merous, shortly pedicellate; **Sep** sessile, basally slightly connate, unequal, oblong to ovate, obtuse, papillose, 2 - 3 mm, suberect; **Pet** basally slightly connate, broadly lanceolate, acute, basally narrowed, papillose along the midrib, white or purp-

lish, 6 - 7 mm, slightly spreading; **NSc** very short, broadly reniform, thick; **Sty** very long and slender, ± 6 mm.

S. copalense Kimnach (CSJA 68(5): 241-244, ill., 1996). **T:** Mexico, Sinaloa (*Baker & al.* 7194c [HNT, MEXU]). – **D:** Mexico (Sinaloa); shaded face of a rock cliff, c. 500 m.

[1] Perennial herbs; annual vegetative shoots arising from the base of the previous year's stems, arching to prostrate, 5 - 25 cm, axis 4 - 5 mm thick, tapering towards the tip, brownish-yellowish to reddish, not farinose; **L** easily falling and rooting to form new plants, obovate, obtuse, rarely minutely cuspidate, pale green, not glaucous, semi-imbricate on sterile shoots and 10 - 15 $\times$ 6 - 7 mm; flowering **Br** terminal, lax, **L** well-spaced, 20 - 28 $\times$ 6 - 10 mm; **Inf** diffusely paniculate with 5 - 10 primary **Br** that further branch; **Ped** 1.5 - 2 mm; **Fl** 5-merous; **Sep** elliptic, $\pm 2.5 \times 1$ mm, light green; **Pet** stellately spreading or slightly recurved, ovate-oblong, acute, with a minute apical **Bri**, white, 4 - 5 $\times$ 2 mm; **NSc** rectangular, $\pm 0.25 \times 0.15$ mm, obtuse, brownish-green; **Ca** erect, 2 - 2.5 mm long, ± 3 mm thick. – *Cytology*: $n = 18$.

Closely related to *S. bellum* according to the prologue. – [H. 't Hart]

S. cormiferum R. T. Clausen (Sedum Trans-Mex. Volcanic Belt, 216-217, ill., 1959). **T:** Mexico, México (*Clausen* 4 [CU]). – **D:** C Mexico.

[1] Biennial herbs producing tiny **Ros** and forming a small subterranean caudex; **L** (of seedlings) alternate, elliptic, ovoid or orbicular, 16 - 32 $\times$ 5 - 8 mm, withering at the end of the first rainy season; flowering **Br** erect or ascending, papillose, reddish-brown or greenish, sometimes branched, **L** oblanceolate or spatulate, obtuse, petiolate, somewhat longer and narrower than those of the **Ros**; **Inf** cymes with 3 paniculate **Br**; **Ped** 2.6 - 8 mm, dark red; **Fl** (4- to) 5- (to 6-) merous; **Sep** basally free, spurred, unequal, clavate-oblanceolate, rounded or truncate, 2.9 - 8.5 $\times$ 1 - 3.2 mm, spreading; **Pet** free, lanceolate or ovate, hooded, greenish-white streaked with pink, ± 3 mm, first spreading then recurved; **Anth** yellow; **NSc** oblong, emarginate, sometimes serrate or doubly emarginate, ± 1.8 mm, dark red with pale yellow; **Fr** erect, with small lips along the ventral suture; **Se** pear-shaped, alveolate, brown, reticulate. – *Cytology*: $2n = 28$.

S. correptum Fröderström (in Handel-Mazzetti, Symb. Sin. 7: 409, 1931). **T:** China, Sichuan (*Handel-Mazzetti* 2674 p.p. [WJ]). – **D:** China (Sichuan, Yunnan), Bhutan; rocky slopes, 3500 - 4300 m. **I:** Fröderström (1931: 39, t. 19).

[2] Perennial herbs, shoots from a short woody base, numerous, densely tufted, erect, sometimes densely papillate, 0.5 - 1 cm tall; **L** alternate, densely imbricate, pseudopetiolate, spatulate to nar-

rowly ovate or obovate, obtuse, densely mamillate or papillate, 2 - 6 mm; flowering **Br** arising from the base, erect or ascending, slender, simple, smooth, $\pm$ 2.5 cm long; **Inf** 1-flowered or to 5-flowered racemes; **Bra** **L**-like; **Ped** 0.6 - 1.5 mm; **Fl** 5-merous, with only 5 **St**; **Sep** broadly sessile, basally connate, semi-ovate, obtuse, 1.5 mm; **Pet** oblong, narrowing towards the base, obtuse, greenish, $\pm$ 3 mm; **Anth** red; **NSc** very long, narrowly linear-spatulate, obtuse, $\pm$ 1.5 mm; **Fr** erect, 2-seeded; **Se** suboblong, probably costate.

Included in Sect. *Filipes* (Fröderström) S. H. Fu and considered to be related to *S. elatinoides* and *S. filipes* (Fu & Fu 1984).

S. corymbosum Grossheim (Vestn. Tiflissk. Bot. Sada 3-4: 171, 1916). **T** [syn]: Azerbaidzhan, Nakhichevan (*Woronow* s.n. [LE]). – **D**: Azerbaidzhan (Nakhichevan, Swant), Russia (Dagestan); dry limestone rocks, lower mountain zone, flowers May to June. **I**: Grossheim (1950: t. 31: fig. 8).

[1] Annual herbs, branching in the upper $\frac{1}{2}$, glandulose-pubescent, 5 - 15 cm tall; **L** sessile, alternate, 10 - 15 mm long, terete, obtuse; flowering **Br** erect; **Inf** symmetrical corymbs; **Fl** (3- to) 5- (to 6-) merous; **Ped** $\pm$ 4 mm, erect; **Sep** triangular or ovoid, 1 - 1.5 mm, acute; **Pet** linear-lanceolate, greenish-white (turning reddish after anthesis), 3.5 - 4.5 mm; **St** shorter than the **Pet**; **Anth** dark violet; **NSc** small, tip irregularly dentate; **Fr** erect, basally connate for $\frac{1}{3}$ - $\frac{1}{2}$, narrowly lanceolate, 4.5 - 5 mm, often reddish-glaucous; **Se** oblong, $\pm$ 0.5 mm, brownish.

Related to *S. pallidum* and distinguished by the more regular corymbose inflorescences, long-pedicellate flowers and fruits, which are connate for $\frac{1}{2}$ of their length. It is further similar to *S. eriocarpum* (esp. ssp. *orientale* and ssp. *porphyreum*) and *S. rubens*. – [V. V. Byalt]

S. corynephyllum Fröderström (Acta Horti Gothob. 10(Appendix): 16, ills., t. 9, 1936). **T**: Mexico (*Purpus* s.n. [US ?]). – **D**: E Mexico (Querétaro, Hidalgo). **Fig. XXXIV.b**

Incl. *Corynephyllum viride* Rose (1905) $\equiv$ *Sedum viride* (Rose) A. Berger (1930) (*nom. illeg.*, Art. 53.1).

[1] Glabrous perennial subshrubs, 20 - 40 cm tall, much branched; **L** subimbricate, alternate, oblanceolate, obtuse, shortly spurred, terete, 20 - 50 mm, spreading; **Inf** panicles with axillary subsessile **Fl**; **Sep** basally free, shortly spurred, unequal, very large, oblong to ovate, obtuse, 4 - 8 mm; **Pet** basally free, semiovate, subobtuse, narrowly mucronate, $\pm$ 5 mm, greenish-yellow; **NSc** broad and low; **Sty** rather broad and short. – *Cytology*: $2n = 68, 136$.

S. craigii R. T. Clausen (CSJA 15: 167-169, ills., 1943). **T**: Mexico, Chihuahua (*Moran* 1478 [CU]). – **D**: Mexico (Chihuahua). **Fig. XXXIV.c**

$\equiv$ *Graptopetalum craigii* (R. T. Clausen) R. T. Clausen (1981).

[1] Perennial herbs with procumbent fleshy stems; **L** alternate, oblong-elliptic, obtuse, subterete, fleshy, 20 - 50 $\times$ 9 - 22 mm, 5 - 8 mm thick, purplish, glaucous; flowering **Br** erect, axillary; **Inf** few-flowered cymes; **Bra** linear, 2 - 4 mm; **Ped** 4 - 7 mm; **Fl** 5-merous; **Sep** elliptic-linear, subacute, 4 - 5 mm, erect; **Pet** oblong-lanceolate, acute, narrowed at the base, 7 - 8 mm, white with purplish striation, erect, tips recurved; **Anth** yellowish-white; **NSc** obovate-reniform, emarginate, white. – *Cytology*: $2n = 60$.

S. crassularia Hamet (Candollea 4: 27, 1929). **T**: Ethiopia (*Schimper* 126 [B, NCY]). – **D**: E Africa (Ethiopia, Kenya, Tanzania).

Incl. *Crassularia sediformis* Hochstetter ms. (s.a.) (*nom. inval.*, Art. 32.1c); **incl.** *Crassula sediformis* Schweinfurth (1867) $\equiv$ *Sedum sediforme* (Schweinfurth) Hamet (1912) (*nom. illeg.*, Art. 53.1).

[2] Slender decumbent glabrous annuals with simple or branched stems to 5 (-10) cm tall; **L** alternate (lower **L** opposite), sessile, tightly clustered, obovate, 4 - 5 $\times$ 2 - 2.5 mm, obtuse, semiterete, blue-green or red; **Inf** few-flowered cymes; **Ped** 2 - 2.5 mm; **Fl** 4- or 5-merous with 8 or 10 (rarely 5) **St**; **Sep** broadly sessile, basally connate, free tips triangular to semi-orbicular, obtuse, 0.6 - 0.7 mm; **Pet** free, broadly ovate, 2 $\times$ 1.5 - 1.8 mm, obtuse, white, pink or purplish; **Fil** 1.2 mm, basally adnate to the **Pet** for 0.1 mm; **Anth** orbicular, $\pm$ 0.6 mm; **NSc** subcylindrical-spatulate; **Sty** slender, $\pm$ 0.5 mm; **Fr** 1- to 3-seeded, circumscissile, opening along an equatorial furrow; **Se** ovoid, 1.4 mm, dark brown, costate.

S. creticum C. Presl (Isis (Jena) 21: 273, 1828). **T** [lecto]: Greece, Crete (*Sieber* s.n. [PRC 764, PRC, W]). – **Lit**: 't Hart (1989). **D**: Greece (Crete, Karpathos).

$\equiv$ *Helladia cretica* (C. Presl) M. Král (1987).

[1] Annual to perennial glandular-pubescent rosette herbs usually with a thickened taproot; **L** alternate, oblong-spatulate, flattened, sessile or pseudopetiolate, obtuse or subacute, glabrous, mamillate or sparsely glandular-pubescent, green or glaucous, to 4 cm long; flowering **Br** erect or ascending, usually simple, glandular-pubescent, 3 - 15 (-20) cm; **Inf** narrow densely glandular-pubescent panicles to 10 cm tall, composed of many few-flowered usually forked cincinni; **Bra** small; **Ped** $\pm$ 1 mm; **Fl** 5- (to 6-) merous; **Sep** broadly sessile, basally slightly connate, triangular-oblong, obtuse or subacute, $\pm$ 2 mm; **Pet** free, lanceolate, acute, brownish- or greenish-white, tinged red, 5 - 7 mm; **Fil** whitish; **Anth** red; **NSc** cuneate, dentate; **Sty** $\pm$ 0.5 mm; **Fr** erect, pale brown or brown, pubescent; **Se** ovoid, pale brown, costate. – *Cytology*: $2n = 22$.

The species belongs to Ser. *Cepaea*. It embraces 2 vicariant ecotypes, which differ to some extent in altitudinal amplitude and geographical distribution. They are fully interfertile, however, and most probably merely represent different phenotypic expressions of a similar genotype in different habitats.

Plants from Libya commonly referred to as *S. creticum* have been described as *S. cyrenaicum*.

S. creticum var. **creticum** – **D:** Greece (E Crete: Dhikti Mts.).

Incl. *Sedum hierapetrae* Rechinger fil. (1943) ≡ *Oreosedum hierapetrae* (Rechinger fil.) Grulich (1984) ≡ *Sedum creticum* var. *hierapetrae* (Rechinger fil.) 't Hart & Hagemann (1986).

[1] Perennial herbs with short branched monopodial or sympodial caudex-forming dense tufts of small **Ros**; flowering **Br** terminal or sometimes axillary.

S. creticum var. **monocarpicum** 't Hart (Taxon 38(4): 650, 1989). **T:** Greece, Crete (*Heldreich* s.n. [G-BOIS]). – **D:** Greece (Crete, Karpathos); low altitudes.

Incl. *Sedum creticum* Boissier & Heldreich (1849) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum cretense* Maire (1977).

[1] Strictly monocarpic (biennial or annual) herbs with flat simple **Ros**; flowering **Br** erect, terminal.

S. cupressoides Hemsley (Diagn. Pl. Nov. Mexic. 11, 1878). – **D:** Mexico (Oaxaca); 2000 - 3000 m. **I:** Praeger (1921a: 245); Fröderström (1936a: 90, t. 57). **Fig. XXXIV.d**

[1] Glabrous perennial herbs with decumbent much-branched stems to 15 cm long; sterile **Br** 2 - 5 cm; **L** densely imbricate, appressed, alternate, ovate-rhomboid or suborbicular, obtuse, very broadly spurred, fleshy, 1.5 - 2 × 1 - 2 mm at the base; flowering **Br** 5 - 10 cm; **Inf** 1- to few-flowered, densely leafy; **Fl** 5-merous; **Sep** basally free, broadly spurred, almost equal, oblong to ovate, obtuse or subobtusely, 1.7 - 2.2 mm; **Pet** basally slightly connate, suboblong, subobtusely, shortly mucronate, yellow, 2 - 5 mm; **NSc** small, slightly broader than long; **Sty** rather long; **Se** ovoid, reticulate-papillose.

Fröderström (1936a: 89) mentioned *S. muscoideum* as synonym.

S. cuspidatum Alexander (CSJA 18(4): 52-53, ill., 1946). **T:** Mexico, Chiapas (*MacDougall* s.n. [NY ?]). – **D:** Mexico (Chiapas).

[1] Glabrous subshrubs with fleshy branching stems, becoming decumbent with age, ± 25 cm long; **L** alternate, narrowly obovate, bluntly cuspidate, carinate, glaucous towards the base, ± 20 × 10 mm, ± 3 mm thick, light yellow-green; flowering **Br** erect, axillary; **Inf** compact cymes; **Bra** erect,

narrowly elliptic, obtuse, ± 7 mm, in the upper 5 cm of **Inf**; **Fl** 5-merous, subsessile; **Sep** unequal, oblanceolate, subacute, 3.5 - 5 mm; **Pet** acute, apiculate-cucullate, canaliculate, white, ± 7 mm, erect, then spreading; **Anth** purplish-brown; **NSc** obovate, truncate-lunate, whitish; **Fr** erect. – *Cytology*: 2n = 68.

S. cymatopetalum Fröderström (Acta Horti Gothob. 10(Appendix): 83-85, fig. 619-628, t. 41, 1935). **T:** Bolivia, Potosi (*Hammarlund* 439 [S]). – **D:** Bolivia, N and C Argentina; high Andes, 3000 - 4000 m. **I:** Zardini (1971: 104). **Fig. XXXIV.e**

[1] Glabrous perennial herbs with napiform or tuberous **R** and 2 - 5 cm long sterile stems; **L** alternate, ovate or almost orbicular, obtuse, tips mamillate, broad and obtusely spurred, 4 - 5 mm; flowering **Br** erect, simple or few-branched, often with sterile **Br** in the **L** axils, 3 - 12 cm; **Inf** terminal elongate panicles or sometimes only 1- to 2-flowered; **Fl** subsessile; **Sep** basally free, spurred, unequal, oblanceolate to oblong, obtuse, green dotted with red, 4 - 5.5 mm, larger than the **Pet**; **Pet** basally connate up to 1 mm, broadly ovate, obtuse, submucronate, tips erose, white to yellowish, ± 4 mm; **NSc** spatulate-subquadrate, broad above, slightly emarginate, flat; **Sty** broad and short; **Se** ovoid, reticulate.

S. cyprum A. K. Jackson & Turrill (BMI 1939: 476, 1939). **T:** Cyprus (*Kennedy* 524 [K]). – **Lit:** Stephenson (1993: with ill.). **D:** S Cyprus; crevices of igneous (rarely limestone) rocks, 150 - 1600 m. **Fig. XXXIII.f**

[1] Monocarpic herbs, erect, 9 - 15 (-35) cm, with a flat basal rather lax **Ros**; **L** shrivelling at or soon after anthesis, flat, broadly spatulate, 3 - 6 × 1 - 2 cm, obtuse or rounded, green in the shade, reddish in the sun, glabrous, margins entire, narrowly scarious, stem **L** numerous, flat, shorter than those of the **Ros** but proportionately wider, thinly glandular-pubescent, continuing as **Bra** into the lower part of the **Inf**; **Inf** usually unbranched cylindrical to narrowly conical panicles, 6 - 16 (-20) cm, axis densely glandular; **Fl** very numerous but less densely crowded than in *S. microstachyum*, 5-merous, 3 - 4 mm pedicellate; **Sep** free almost to the base, ovate-acuminate, glandular, ± 1.5 × 0.8 mm; **Pet** narrowly ovate-acuminate, keeled, ± 2.5 × 1 mm, reddish or greenish; **Fil** minutely papillose towards the base; **NSc** not described; **Ca** erect, narrowly ovoid, glabrous or very weakly glandular, ± 1.8 mm, tapering into the slender 1 mm long **Sty**; **Fr** erect, 2.5 - 3 mm; **Se** numerous, oblong-ellipsoid, ± 0.4 × 0.2 mm, medium-brown, with numerous closely arranged longitudinal ribs.

Related to *S. cepaea* and very close to *S. lampusae* with equally glabrous rosette leaves and *S. microstachyum* with glandular-pubescent rosette leaves. – [U. Eggli]

S. cyrenaicum Brullo & Furnari (Webbia 34(1): 162-163, ill., 1979). **T:** Libya, Cyrenaica (*Brullo & Furnari* s.n. [CAT]). – **D:** NE Libya (Cyrenaica); shady rock walls.

[1] Perennial herbs, offsetting and with sterile **Ros** present at flowering time; **Ros** sessile; **L** linear-spatulate, 12 - 22 × 3 - 5 mm, lower parts glandular-hairy; flowering **Br** terminal, 3 - 15 cm, simple or basally branched, **L** alternate or rarely almost verticillate, linear-spatulate to ovate-oblong, 3 - 7 × 1.5 - 3 mm; **Inf** consisting of 3- to 6-flowered cymes; **Fl** 5-merous; **Sep** 5 mm, outside glandular-hairy; **Pet** 4 × 1.2 mm, with green centre and white margins, long-apiculate, with 3 red veins, outside glandular-hairy; **NSc** not described; **Ca** 3 mm, glandular-hairy ventrally; **Se** not described.

These Libyan plants are but doubtfully distinct from *S. creticum* (classified in Ser. *Cepaea*), differing primarily by their perennial habit with sterile rosettes present at flowering time. – [U. Egli]

S. daigremontianum Hamet (Bull. Soc. Bot. France 56: 234-236, 1909). **T:** China (*Wilson* 3632 [P]). – **D:** China (Sichuan, Gansu); on rocks and mountain slopes, 2300 - 4000 m.

[1] Perennial or annual herbs with slender erect or ascending non-flowering shoots; **L** alternate, (sub-) imbricate, appressed or erect, linear, acuminate, 4 - 13 mm, with a trilobate spur; flowering **Br** erect or ascending, much branched from the base, 9 - 20 cm; **Fl** 5-merous; **Sep** broadly sessile, slightly unequal, narrowly lanceolate, acuminate; **Pet** connate for up to 1.5 mm, lanceolate to oblong, long mucronate, erose, yellowish or white; **NSc** linear-terete; **Fr** erect or somewhat divergent; **Se** reticulate-papillose.

Closely related to *S. dumulosum* and *S. liciae* according to Fröderström (1931), but this is unlikely, and both these taxa are here treated as taxa of *Rhodiola*.

S. daigremontianum var. **daigremontianum** – **D:** China (W Sichuan). **I:** Fröderström (1931: 46, t. 26).

[1] Probably perennial herbs with sparse slender erect stems to 5 cm; **Sep** 4.5 - 6 mm, shorter than the **Pet**; **Pet** 6 - 7 mm, yellowish.

S. daigremontianum var. **macrosepalum** Fröderström (Acta Horti Gothob. 7(Appendix): 114, figs. 927-937, t. 63, 1932). **T:** China, Gansu (*Hummel* 5175 [S]). – **D:** China (S Gansu, C Sichuan).

[1] Annual or perennial herbs with ascending stems to 12 cm; **Inf** few-flowered, involucre; **Sep** 8.5 - 9 mm, longer than the **Pet**; **Pet** ± 8 mm, white; **NSc** slightly broadening towards the tip.

Fröderström (1932) and Fröderström (1942) gave different sepal and petal lengths for this taxon.

S. dasyphyllum Linné (Spec. Pl. [ed. 1], 431,

1753). **T:** UPS [lecto: Herb. Burser, vol. 16(1): 60]. – **D:** S and C Europe, Turkey (Anatolia), N Africa; from sea-level to over 2500 m.

≡ *Leucosedum dasyphyllum* (Linné) Fourreau (1868) (*nom. inval.*, Art. 11.4) ≡ *Oreosedum dasyphyllum* (Linné) Grulich (1984); **incl.** *Sedum dasyphyllum* var. *glaucum* Lit. (s.a.) ≡ *Sedum dasyphyllum* fa. *glaucum* (Lit.) Tavormina (1999) (*nom. inval.*, Art. 33.2); **incl.** *Sedum globiferum* Pourret (1788); **incl.** *Sedum nebrodense* Gasparrini ex Gusone (1842); **incl.** *Sedum dasyphyllum* var. *donatianum* Visiani & Saccardo (1869) ≡ *Sedum dasyphyllum* fa. *donatianum* (Visiani & Saccardo) Tavormina (1999) (*nom. inval.*, Art. 33.2); **incl.** *Sedum dasyphyllum* var. *macrophyllum* Rouy & Camus (1901); **incl.** *Sedum dasyphyllum* fa. *oppositifolium* Maire (1977) (*nom. inval.*, Art. 36.1, 37.1); **incl.** *Sedum dasyphyllum* var. *elisae* Tavormina (1999) (*nom. inval.*, Art. 36.1, 37.5).

[1] Glandular-pubescent glaucous often tufted perennial herbs with short branching and rooting stems; **L** densely imbricate, ovoid or subglobose, sessile, obtuse or acute, flattened on the upper face, glaucous, glabrous to densely and coarsely glandular-pubescent, sometimes sticky, 3.5 - 7 mm; flowering **Br** erect or ascending, usually simple and densely glandular-pubescent with loosely imbricate alternate **L**, to 12 cm tall; **Inf** cymes with (1-) 2 (-3) cincinni; **Bra** small, ovate; **Ped** shorter than the **Fl**; **Fl** 5-merous (rarely 6-merous); **Sep** broadly sessile, ovate, 1 - 5.5 mm; **Pet** basally free, oblong-elliptic to lanceolate, (sub-) acute, white, often with a red keel or pinkish, outside glaucous, purplish-green, 3 - 5 mm; **Fil** white; **Anth** red; **NSc** yellow, spatulate; **Sty** short, curved outwards; **Fr** erect, brown or bluish; **Se** ovoid, pale brown, costate. – *Cytology*: 2n = 28, 42, 56, 70, 84, 96, 112.

Extremely variable with regard to phyllotaxis, shape and pubescence of the leaves, position of the flowering branches, and shape and size of the inflorescences and flowers, particularly in N Africa, S Spain, S Italy, Sardinia and Corsica. The type specimen represents the C European moderately pubescent form with opposite, ovate, semiterete leaves. Although the typical form is quite distinct, it is impossible to separate it unequivocally from other forms. Consequently, we distinguish only 2 varieties. The species is closely related to *S. mucizonia* and *S. wilczekianum*, and can be hybridized with the former annual species ('t Hart & al. 1999).

S. dasyphyllum var. **dasyphyllum** – **D:** Throughout the area of the species; the dominant form in S, C and SE Europe and Anatolia, rare in N Africa and the W Mediterranean region. **Fig. XXXIV.f**

Incl. *Sedum glaucum* Lamarck (1778); **incl.** *Sedum reticulatum* Schrank (1815); **incl.** *Sedum dasyphyllum* var. *genuinum* Grenier & Godron (1848) (*nom. inval.*, Art. 24.3); **incl.** *Sedum englerianum* Graebner (1896); **incl.** *Sedum dasyphyllum* subvar.

glabratum Rouy & Camus (1901); **incl.** *Sedum dasyphyllum* var. *adenocladum* Burnat (1906) $\equiv$ *Sedum dasyphyllum* subvar. *adenocladum* (Burnat) Maire (1977); **incl.** *Sedum dasyphyllum* ssp. *eudasyphyllum* Maire (1932) (*nom. inval.*, Art. 26.1); **incl.** *Sedum dasyphyllum* var. *eudasyphyllum* Maire (1932) (*nom. inval.*, Art. 26.1).

[2] **L** decussate (rarely with some non-flowering shoots with alternate **L**), semiterete to subterete, ovate to elliptic or obovate, glabrous or glandular-pubescent, but **Ha** not conspicuously white and coarse; flowering **Br** terminal. – *Cytology*: $2n = 28, 42, 56$.

The typical C and S European and Anatolian form with ovate, bluish-glaucous, opposite leaves is tetraploid ($2n = 56$) and belongs to a single monophyletic lineage within the *S. dasyphyllum* complex that most probably evolved from a W Mediterranean diploid ($2n = 28$) form with alternate leaves. In plants with opposite leaves from N Africa and SW Europe, this character may have evolved independently, because they belong to a different lineage within the *S. dasyphyllum* complex.

S. dasyphyllum var. **glanduliferum** (Gussone) Moris (Fl. Sardoia 2: 126, 1840). – **D**: The dominant form in N Africa, SW Europe (Sicily, Sardinia, Corsica, S Spain, S Portugal), rare in S Europe, absent in C and SE Europe and Anatolia.

$\equiv$ *Sedum glanduliferum* Gussone (1827) $\equiv$ *Sedum dasyphyllum* ssp. *glanduliferum* (Gussone) Nyman (1879); **incl.** *Sedum dasyphyllum* var. *glutinosum* Maire (s.a.); **incl.** *Sedum corsicum* Duby ex De Candolle (1828); **incl.** *Sedum neapolitanum* Tenore (1831); **incl.** *Sedum dasyphyllum* var. *vulgare* Moris (1840); **incl.** *Sedum pulligerum* Pomel (1875) $\equiv$ *Sedum dasyphyllum* fa. *pulligerum* (Pomel) Battandier (1889) $\equiv$ *Sedum dasyphyllum* var. *pulligerum* (Pomel) Maire (1977); **incl.** *Sedum dasyphyllum* var. *oblongifolium* Ball (1878) $\equiv$ *Sedum dasyphyllum* ssp. *oblongifolium* (Ball) Maire (1928); **incl.** *Sedum granatense* Pau (1895) $\equiv$ *Sedum dasyphyllum* ssp. *granatense* (Pau) Castroviejo & Velayos (1995); **incl.** *Sedum burnatii* Briquet (1901); **incl.** *Sedum donatianum* Visiani & Saccardo ex Dalla Tore & Sarnthein (1909); **incl.** *Sedum dasyphyllum* var. *suendermannii* Praeger (1919) $\equiv$ *Sedum dasyphyllum* cv. *Suendermannii* (s.a.); **incl.** *Sedum dasyphyllum* var. *dyris* Maire (1928); **incl.** *Sedum dasyphyllum* var. *rifanum* Maire (1928); **incl.** *Sedum dasyphyllum* var. *congestum* Cuatrecasas (1930); **incl.** *Sedum dasyphyllum* var. *mesatlanticum* Litardière & Maire (1931); **incl.** *Sedum dasyphyllum* var. *alternum* Maire (1932) $\equiv$ *Sedum dasyphyllum* fa. *alternum* (Maire) Maire (1977); **incl.** *Sedum moroderi* Pau (1934) $\equiv$ *Sedum dasyphyllum* var. *moroderi* (Pau) O. Bolòs & J. Vigo (1984).

[2] Non-flowering shoots creeping, forming mats or tufts, sometimes profusely branched; **L** alternate (rarely with some non-flowering shoots with oppos-

ite **L**), semiterete to subterete or flat, ovate to orbicular, elliptic or obovate, usually densely glandular-pubescent, often with coarse whitish glandular **Ha**, sometimes sticky, rarely glabrous; flowering **Br** terminal, rarely axillary. – *Cytology*: $2n = 28, 42, 56, 70, 84, 96, 112$.

Var. *glanduliferum* specifically relates to plants with alternate leaves. In all other characters it covers the whole range of cytological and morphological variation otherwise found within this extremely variable species complex.

S. debile S. Watson (Bot. US Geol. Expl. 40. Parallel, 102, 1871). **T**: USA, Nevada (*Watson* 387 [GH]). – **D**: W USA (Great Basin, C Rocky Mountains etc.); open rocky places, 1500 - 3500 m. **I**: Fröderström (1936a: 46, t. 29); Clausen (1975: 313).

$\equiv$ *Gormania debilis* (S. Watson) Britton (1903) $\equiv$ *Cotyledon debilis* (S. Watson) Fedde (1904) $\equiv$ *Echeveria debilis* (S. Watson) A. Nelson & Macbride (1913) $\equiv$ *Amerosedum debile* (S. Watson) A. Löve & D. Löve (1985).

[2] Glabrous perennial tufted herbs with slender decumbent fragile stems, propagating through axillary shoots forming compact almost globular **Ros**; **L** decussate (rarely alternate), elliptic, sometimes ovate-elliptic, broadly rounded, sometimes weakly emarginate, minutely papillose at the tip, subterete, almost globular, sessile, clasping, $4.2 - 7.2 \times 2.8 - 4.3$ mm, pale glaucous-green, speckled with pink, sometimes pink or red; flowering **Br** erect, decumbent or ascending, 3 - 12 cm; **Inf** cymes with 2 **Br**; **Bra** **L**-like but smaller; **Ped** 0 - 1.2 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, equal, lanceolate, obtuse, papillose, pale green and glaucous, $\pm 3.5 \times 1.5$ mm, erect; **Pet** basally connate, elliptic-lanceolate, obtuse, with a mucronate appendage, yellow, ± 7.5 mm, widely spreading above the erect bases; **Fil** yellow; **Anth** yellow, sometimes compressed and winged; **NSc** reniform to square, truncate, yellow, orange-red or salmon-pink; **Fr** erect, straw-coloured with purple stripes; **Se** pear-shaped, yellow to pale brown, costate. – *Cytology*: $2n = 14 - 18$.

S. decipiens (Baker) Thiede & 't Hart (Novon 9: 124, 1999). **T**: Peru (*Farris* s.n. [lecto - icono: Refug. Bot. 3: t. 200, 1870]). – **D**: Peru; known from the type collection only.

$\equiv$ *Cotyledon decipiens* Baker (1870) $\equiv$ *Echeveria decipiens* (Baker) E. Morren (1874) $\equiv$ *Altamiranoa decipiens* (Baker) Fröderström (1936) $\equiv$ *Villadia decipiens* (Baker) H. Jacobsen (1958).

[1] Glabrous herbs; sterile stems 5 - 7.5 cm, often branched, flowering **Br** arcuate, 15 - 20 cm; **L** moderately dense, erect-patent, numerous, subterete, lower face more strongly rounded than the upper face, blunt, basally spurred, largest **L** ± 12 mm, upper **L** smaller, pale green; **Inf** with 2 - 3 cincinnoid **Br**

with 12 - 15 densely arranged **Fl** in total; **Ped** almost none; **Sep** lanceolate, fleshy, appressed to the **Cl**, subequal, 4 mm; **Cl** round in cross-section; **Pet** pure white, tube 4 mm, equalling the **Cal**, lobes lanceolate-deltoid, falcately spreading, 4 mm; episepal **St** inserted low down in the **Cl** tube.

This species is only known from the type collection, and was never recollected since (Brunner 1993). Since the type specimen is not extant, the illustration accompanying the protologue was chosen as lectotype (Thiede & 't Hart 1999). – [J. Thiede]

S. dendroideum De Candolle (Coll. Mém. 2, Crass., 37, t. 9, 1828). – **D**: Mexico, Guatemala. **I**: Fröderström (1936a: 8, t. 1-2).

[1] Perennial shrubs with erect, pendulous or prostrate stems; **L** alternate, elliptic-ob lanceolate, spatulate or obovate, rounded, obtuse or apiculate, sessile or petiolate, fleshy, lustrous, light green, sometimes red or dotted with red marginally, 15 - 94 × 7 - 37 mm; flowering **Br** axillary; **Inf** elongated panicles; **Fl** 5-merous (rarely 4- or 6-merous), sessile or subsessile; **Sep** broadly sessile, sometimes minutely spurred, usually free, unequal, ovate, lanceolate or elliptic-oblong, obtuse, green, 1.5 - 9.6 × 1 - 3.2 mm, erect; **Pet** free or basally slightly connate, lanceolate, acute or obtuse, mucronate, carinate, yellow, ± 7.5 mm, upper $\frac{2}{3}$ spreading; **Anth** yellow; **NSc** subquadrate or reniform, truncate, broadly rounded or emarginate, yellowish or translucent; **Fr** widely divergent, with small lips along the ventral suture, brown; **Se** ellipsoidly pear-shaped, finely verrucose, brown, reticulate. – *Cytology*: 2n = 60.

S. dendroideum ssp. **dendroideum** – **D**: S Mexico (Sierra Madre del Sur), Guatemala (C American volcanic upland); on rocks, ± 1700 - 1800 m. **I**: Clausen (1959: 71). **Fig. XXXV.a**

[1] **L** spatulate, broadly rounded, with reddish or dark green **GI** at the margins, cuneate, basally petiolate, ± 41 × 17 mm, ± 4 mm thick.

S. dendroideum ssp. **monticola** (Brandege) R. T. Clausen (Sedum Trans-Mex. Volcanic Belt, 73, ill. (p. 80), 1959). **T**: Mexico, México (*Purpus* 7690 [UC]). – **D**: Mexico (México).

≡ *Sedum monticola* Brandege (1919) ≡ *Sedum praealtum* ssp. **monticola** (Brandege) R. T. Clausen (1975).

[1] Perennial subshrubs 6 - 10 cm tall; **L** spatulate to oblanceolate, apiculate, obscurely petiolate, 65 - 91 × 24 - 30 mm, 2 - 3 mm thick; **Inf** dense corymbs or subpaniculate; **Sep** ± 8 × 2.5 mm; **Pet** 2.5 - 3.6 mm wide; **NSc** emarginate; **Sty** long, reflexed.

Based on inadequate type material.

S. dendroideum ssp. **parvifolium** R. T. Clausen

(Sedum Trans-Mex. Volcanic Belt, 72-73, 1959). **T**: Mexico (Clausen 1 [CU]). – **D**: C Mexico (E Trans-Mexican Volcanic Belt, adjacent C Mexican plateau); on rocks in the *Abies*-zone.

≡ *Sedum praealtum* ssp. **parvifolium** (R. T. Clausen) R. T. Clausen (1975).

[1] **L** oblanceolate, obscurely petiolate, 40 - 52 × 17 - 18 mm, 2 - 3 mm thick; **Sep** ± 3 mm; **Pet** 2.5 - 3.6 mm wide.

S. dendroideum ssp. **praealtum** (A. De Candolle) R. T. Clausen (Sedum Trans-Mex. Volcanic Belt, 70, ill. (p. 71), 1959). **T**: G ?. – **D**: C Mexico, Guatemala; on sandy loams, ± 1300 m; naturalized in Italy and Australia (Queensland). **Fig. XXXV.b**

≡ *Sedum praealtum* A. De Candolle (1847).

[1] **L** oblong-elliptic, sessile, 46 - 67 × 16 - 22 mm, 2 - 3 mm thick; **Pet** ± 2.1 mm wide. – [H. 't Hart]

S. didymocalyx Fröderström (Acta Horti Gothob. 15: 21-22, figs. 118-125, 1942). **T**: China, Sichuan (*Smith* 11693 [UPS ?]). – **D**: China (W Sichuan); alpine grasslands, rock crevices, 4400 - 4700 m.

Incl. *Sedum froderstromii* Hamet ex Fröderström (1942) (*nom. inval.*, Art. 34.1a).

[1] Tiny basally branched annual herbs 1 - 2 cm tall; **L** subovate to oblanceolate, obtuse, 3-5.5 mm; flowering **Br** branched from the base, divergent; **Inf** 1- to 3-flowered; **Bra** oblanceolate, 4 - 5 mm; **Fl** 5-merous; **Sep** 8 to 10 in 2 alternating whorls, basally free, shortly spurred, subovate to broadly oblanceolate, subacute to obtuse, ± 5 mm; **Pet** free, oblong, obtuse, narrowing to the base, yellow, ± 5.5 mm; **NSc** linear, obtuse with slightly dilated tip; **Sty** rather long; **Fr** divergent, turgid, many-seeded; **Se** subovoid, reticulate-papillose.

The 2 whorls of sepals of this species are unique within the family and the feature needs further study.

S. dielsii Hamet (Malpighia 26: 57-59, 1913). **T**: China (*Giraldi* s.n. [FI [Herb. Biondi 3335]]). – **D**: China (S Gansu, W Hubei, N Sichuan); rocks, 700 - 1900 m. **I**: Fröderström (1931: 76, t. 42); Fu & Fu (1984: t. 28).

≡ *Sedum leblanciae* var. **dielsii** (Hamet) Fröderström (1931); **incl.** *Sedum angustipetalum* Fröderström (1932).

[1] Perennial or annual herbs with spreading branched glabrous stems 6 - 11 cm; **L** in whorls of 4, spatulate-oblong, mamillate towards the tip, 7 - 11 mm; **Inf** rather dense corymbs; **Fl** 5-merous, subsessile; **Sep** broadly sessile, oblong- to linear-spatulate, unequal, obtuse, mamillate towards the tip, 2.5 - 5 mm; **Pet** oblong to semi-ovate, subacute, 4 - 8 mm; **NSc** broadly linear-spatulate, emarginate; **Sty** rather long; **Fr** suberect or divergent; **Se** large, reticulate-papillose.

The description of *S. angustipetalum* differs in

many respects from *S. dielsii* and it remains to be ascertained whether the classification by Fu & Fu (1984), presented here, is the most plausible. Fröderström (1932), however, compared it to *S. morotii* (here treated as *S. obtusipetalum*) and *S. obtusipetalum*.

S. diffusum S. Watson (Proc. Amer. Acad. Arts 25: 148, 1890). **T** [syn]: Mexico, Nuevo León (*Pringle* 2509 [GH, KFTA]). – **D**: Mexico (Nuevo León, Hidalgo, San Luis Potosí: Sierra Madre Oriental); ± 900 m. **I**: Fröderström (1936a: 95, t. 60).

[1] Perennial herbs with widely branching **R**-stock and short stems with slender **Br**; **L** oblong-linear, obtuse, spurred, subterete, 3 - 12 × 1 - 3 mm; flowering **Br** erect, axillary; **Bra** lanceolate, 3 - 4 mm; **Fl** 5-merous, sessile; **Sep** basally slightly connate, very shortly spurred, unequal, ovate to obovate-linear, rounded to subobtusate, 1.5 - 3 mm; **Pet** basally connate, oblong, acute, narrowly mucronate, 4 - 5 mm; **NSc** shortly stipitate, broadly spatulate-orbicular, deeply emarginate; **St** very short; **Fr** widely divergent; **Se** pear-shaped, dark brown, reticulate-papillose. – *Cytology*: 2n = 38, 39, 76, 114.

S. diminutum (R. T. Clausen) G. L. Nesom (Phytologia 79(4): 261, 1996). **T**: Mexico, Coahuila (Clausen 78-7 [BH]). – **Lit**: Nesom & Turner (1996). **D**: Mexico (Coahuila: NW of Cuatro Ciénegas); limestone rocks, 1860 m, known from the type only.

≡ *Sedum parvum* ssp. *diminutum* R. T. Clausen (1979).

[1] Prostrate-decumbent perennial herbs with somewhat woody rhizomes; stems green, smooth, with a golden sheen below; **L** evenly sized and spaced, very flat, narrowly elliptic-oblong to narrowly oblanceolate-oblong, 3.7 - 5.5 × 1.3 - 1.8 mm; flowering **Br** with diffusely arranged **Fl** along the upper parts, not congested in cincinni; **Pet** erect, yellow, 3 - 3.5 mm; **Anth** red.

Only recently raised to species rank and closely similar to *S. parvum*. – [U. Eggli]

S. dimorphophyllum K. T. Fu & G. Y. Rao (Acta Bot. Boreal.-Occid. Sin. 8(2): 117-118, ill. (p. 120), 1988). **T**: China, Sichuan (*Sichuan Exped. Biol. Res.* 304 [CDBI]). – **D**: China (W Sichuan); shady moist rocks in ravines, 2800 - 2900 m.

[1] Perennial herbs with fleshy stems, thick when older and 2 - 4 cm long; **L** basally in whorls, alternate higher up along the stem, crowded, either linear or lanceolate, obtuse, spurred, 8 - 20 × 2 - 3 mm; flowering **Br** prostrate, then ascending, 5 - 12 cm; **Inf** few-flowered, simple or dichotomously branching cymes; **Bra** L-like, ± 6 mm; **Fl** 5-merous; **Sep** broadly sessile, unequal, narrowly triangular, lanceolate, obtuse, 2.5 - 4.5 × ± 1 mm; **Pet** free at the base, oblong-lanceolate, mucronate, pale yellow, ± 5 mm; **NSc** subrectangular, truncate or emarginate;

Sty ± 1 mm; **Fr** stellately patent, with lips along the sutures; **Se** narrowly ovate, longitudinally mamillate.

S. dispernum Fröderström (Acta Horti Gothob. 10(Appendix): 130-131, ill., t. 90, 1936). **T**: Mexico, Jalisco (*Rose* 2991 [NY]). – **D**: Mexico (N Jalisco, Aguascalientes?).

[1] Glabrous perennial herbs with napiform **R**; **L** alternate, oblong, obtuse, shortly spurred, 3.5 - 4 mm; flowering **Br** erect, simple below, few-branched above, 6 - 8 cm; **Inf** small few-flowered corymbs; **Bra** oblanceolate or oblong, ± 3 mm; **Sep** basally free, shortly spurred, unequal, oblong, obtuse, 3 - 4 mm; **Pet** basally slightly connate, broadly lanceolate, obtuse, very broadly and shortly mucronate, ± 5 mm, white; **NSc** narrowly linear, flat at the tip; **Fr** 2-seeded; **Se** ovoid, reticulo-papillose.

Probably synonymous with *S. pringlei* (Clausen 1978: 223). – [H. 't Hart, B. Bleij & U. Eggli]

S. divergens S. Watson (Proc. Amer. Acad. Arts 17: 372, 1882). **T**: USA, Washington (*Suksdorf* 369 [GH]). – **D**: SW Canada (British Columbia), W USA (Washington, Oregon, N California); to 2300 m. **I**: Fröderström (1936a: 95, t. 59); Clausen (1975: 303).

≡ *Amerosedum divergens* (S. Watson) A. Löve & D. Löve (1985); **incl.** *Sedum umbellatum* auct. (s.a.) (*nom. inval.*, Art. 29.1).

[2] Glabrous perennial herbs with slender **R**-stock and branched decumbent stems, rooting freely at the nodes; **L** closely set, decussate (rarely alternate), suborbicular or spatulate-obovate, rounded, thick and turgid but subterete, almost globular, sessile, slightly subcordate with clasping base, 4.1 - 8.9 × 4.1 - 6.1 mm, green or reddish-green; flowering **Br** erect, simple, rarely branched, ± 9.5 cm; **Inf** terminal cymes with 2 - 3 **Br**; **Bra** elliptic, obtuse; **Ped** 0 - 2.8 mm, enlarged apically; **Fl** 5-merous (rarely 6- or 7-merous); **Sep** broadly sessile, basally connate, ovate, obtuse, 2 - 3 × 1.5 - 2 mm, green; **Pet** free, sometimes basally slightly connate, elliptic-lanceolate, acute or obtuse, with a mucronate appendage, yellow, ± 6 mm, erect basally, then spreading; **Fil** yellow; **Anth** yellow; **NSc** subquadrate, truncate, slightly emarginate, yellow; **Fr** widely spreading, basally firmly connate; **Se** pear-shaped, yellow-brown, costate. – *Cytology*: 2n = 16.

S. dolosum K. T. Fu (Bull. Bot. Lab. N.-E. Forest. Inst., Harbin 6: 39-40, ill. (p. 43), 1980). **T**: China, Yunnan (*Li* 0679 [Herb. Bor.-occid. Inst. Bot.]). – **D**: China (Yunnan); on rocks, ± 1400 m.

[1] Annual herbs with erect terete stems, branched above the middle, to 20 cm tall; **L** alternate, long-linear, acute, obtusely spurred, 10 - 16 × ± 1.5 mm; **Inf** few- to many-flowered corymbs; **Fl** 5-merous, sessile or shortly pedicellate; **Sep** basally

free, shortly spurred, unequal, narrowly triangular-lanceolate, acute, 3 - 5 mm; **Pet** slightly connate at the base, lanceolate to oblong, acute, yellow with brown stripes, $\pm$ 5 mm; **NSc** linear-spatulate, rounded; **Fr** erect, narrowly ovate.

Belonging to Sect. *Oreades* and resembling *S. franchetii* in habit according to the protologue. Fu & Ohba (2001: 244) classify this taxon as synonym of *S. multicaule* ssp. *multicaule*. – [H. 't Hart, B. Bleij & U. Eggli]

S. dongzhiense D. Q. Wang & Y. L. Shi (Bull. Bot. Res., Harbin 10(3): 48-49, ill., 1990). **T:** China, Anhui (Wang & Shi Youli 8745 [Herb. Anhui Tradit. Medic. College]). – **D:** China (S Anhui); $\pm$ 230 m.

[1] Perennial herbs with prostrate rooting and then erect stems; **L** alternate, spatulate-oblong to oblanceolate to subrhomboid and tapering into a cuneate petiole, narrowing towards the base, obtuse, 30 - 45 $\times$ 6 - 18 mm; flowering **Br** erect or ascending, to 25 cm; **Inf** lax many-flowered cymes with 4 - 5 sometimes forked cincinni; **Bra** oblanceolate to subrhomboid, obtuse, basally cuneate, 2 - 4.5 mm; **Ped** to 6 mm; **Fl** 4-merous; **Sep** narrowly triangular, obtuse, $\pm$ 1 mm; **Pet** linear-lanceolate, acute, yellow, $\pm$ 7 mm; **NSc** subtriangular, retuse; **Sty** to 2 mm; **Fr** stellately divergent; **Se** long ovoid, brown, (reticulate-) papillose.

Resembling *S. tetractinum* (Wang & al. 1990).

S. drymarioides Hance (J. Bot. 3: 379, 1865). **T:** China, Guangdong (*Sampson* s.n. [not located]). – **D:** SE China, Taiwan, Japan (Kyushu); on limestone. **I:** Tang & Huang (1989: 165); Tang & Huang (1993: 22).

Incl. *Sedum urayense* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Sedum uraiense* Hayata (1916); **incl.** *Sedum drymarioides* var. *genuinum* Hamet (1924) (*nom. inval.*, Art. 24.3); **incl.** *Sedum drymarioides* var. *toyamae* H. Hara (1960).

[2] Glandular-pubescent annual or biennial herbs with prostrate then erect stems to 20 cm tall, fleshy; **L** opposite or in whorls of 4, alternate in the upper stem parts, broadly ovate, obtuse, abruptly cuneate at the base, long-petiolate, 10 - 40 $\times$ 8 - 22 mm; flowering **Br** ascending, slender, much branched, to 25 cm; **Inf** few-flowered lax panicles; **Ped** slender; **Fl** 5-merous; **Sep** broadly sessile, oblong to broadly linear or lanceolate, obtuse to subacute, densely pubescent, to 2 mm; **Pet** lanceolate or oblong, acute to acuminate, pubescent along the midrib, white, 3 - 4 mm; **NSc** broadly spatulate, deeply emarginate to sublobate; **Fr** subdivergent, ellipsoid, acute, with 8 - 13 deep longitudinal grooves, glabrous; **Se** oblong, dark brown, either costate or bipapillate.

Var. *toyamae* Hara differs from typical *S. drymarioides* by its denser indumentum and allegedly longer pedicels (see also Fröderström (1931).)

S. dugueyi Hamet (J. Bot. 54(Suppl. 1): 24, 26-30,

1916). **T:** China, Sichuan (Wilson 3632A [K]). – **D:** China (NW Sichuan, NW Yunnan); forested slopes, rocks in valleys, 2000 - 3600 m. **I:** Fröderström (1931: 49, t. 29); Fu & Fu (1984: t. 25).

[1] Perennial herbs with several slender stems 1 - 3 cm long; **L** alternate, imbricate, erect, broadly triangular to semi-oblong, acuminate, 3 - 7 mm, with a trilobate or obtuse spur; flowering **Br** ascending, branched at the base, 8 - 10 cm; **Inf** few-flowered lax panicles; **Fl** 5-merous; **Sep** basally free, shortly spurred, semi-oblong, acuminate, 4 - 6 mm; **Pet** basally connate, ovate, acute, long mucronate, colour unknown, 6.5 - 8 mm; **NSc** linear-spatulate, emarginate; **Fr** erect or divergent; **Se** smooth.

S. dulcinomen G. L. Nesom (Phytologia 79(4): 265, 1996). **T:** Mexico, Nuevo León (Meyer & Rogers 2699 [BH]). – **D:** Mexico (Nuevo León near border to Tamaulipas); limestone ledges and outcrops in pine woods, 1750 - 2000 m.

[1] Prostrate-decumbent perennial herbs with horizontal slightly woody rhizomes; stems and **L** strongly glaucous (less so when cultivated); stems arching upwards from the rhizome, green, developing a red hue with time but without clearly delimited red dots; **L** of different size along the stems, green, flat, elliptic-oblong, 2.5 - 4.5 $\times$ 1.5 - 2 mm; flowering **Br** as in *S. parvum*; **Pet** erect, 4.5 - 6 mm long, yellow.

Another member of the *S. parvum* group (Nesom & Turner 1996) and compared with *S. catorce*, *S. papillicaulum* and *S. macdonaldii* in the protologue. – [U. Eggli]

S. duthiei Fröderström (Acta Horti Gothob. 6(Appendix): 57-58, ill., t. 35, 1931). **T:** India, Kumaon (Duthie 2919 p.p. [K]). – **D:** NE India.

[1] Tiny annual herbs with spreading stems, branched from the base, 1 - 2.5 cm tall; **L** alternate, broadly linear to semi-oblong or almost ovate higher up on the stems, subobtuse, 4 - 4.5 mm; **Inf** lax corymbs; **Bra** broadly oblong, subobtuse, 4 - 5 mm; **Ped** 2 - 3 mm; **Fl** 4-merous with 4 - 7 **St**; **Sep** broadly sessile, slightly unequal, broadly ovate, subobtuse or subacute, 2.6 - 3.5 mm; **Pet** semi-oblong, obtuse, 3.5 - 4.5 mm; **NSc** narrowly linear, slightly emarginate or obtuse; **Sty** short; **Fr** erect; **Se** reticulate-papillose.

S. ebracteatum De Candolle (Coll. Mém. 2, Crass., 37, ill., 1828). – **D:** Mexico (widespread from Durango to Puebla and Oaxaca). **I:** Fröderström (1936a: 73, t. 45).

$\equiv$ *Sedastrum ebracteatum* (De Candolle) Rose (1905).

[1] Perennial herbs with dense **Ros** and secondary shoots near the base of the flowering **Br**; **R** $\pm$ fusiform and thickish; **L** of **Ros** alternate, suborbicular to spatulate-oblong, rounded to obtuse or subacute, pubescent, light greenish, 10 - 42 $\times$ 8 - 28

mm; **L** of flowering **Br** ovate to oblong, $\pm$ cordate, larger than those of the **Ros**; flowering **Br** erect, 17 - 25 cm; **Inf** lax panicles; **Fl** 5-merous, sessile, with musky scent; **Sep** broadly sessile, basally connate, equal or unequal, ovate, acute or obtuse, glabrous or minutely pubescent, 3 - 5 $\times$ 1.8 - 3.6 mm, erect; **Pet** basally connate, ovate or elliptic-ovate, acute, mucronate, white, $\pm$ 6 mm, recurved; **Anth** yellow or reddish, papillose; **NSc** ovate or ovate-oblong, truncate or obtusely 2-dentate, pale yellow or white; **Fr** suberect or spreading, with small lips along the ventral suture, pale brown; **Se** pear-shaped, brown, reticulate. – *Cytology*: $2n = 40, 41, 80, 81, 82, 160, 161, 180 \pm 10, 180 - 200, 200 \pm 2, 210 \pm 2, 210 - 220, 200 \pm 10, 230 - 240, 236 \pm 3, 240, 250 \pm 10, 280 - 300$.

Fröderström distinguished 2 varieties; var. *rubricaule* with sepals of equal length, and var. *ebracteatum* with unequal sepals. Here, the classification of Clausen is followed.

S. ebracteatum ssp. **ebracteatum** – **D**: Mexico (C Mexican Plateau, Trans-Mexican Volcanic Belt); $\pm$ 2300 m. **I**: Clausen (1959: 237). **Fig. XXXV.c**

Incl. *Sedum incertum* Hemsley (1878) $\equiv$ *Sedastrium incertum* (Hemsley) Rose (1905); **incl.** *Sedum chapalense* S. Watson (1887) $\equiv$ *Sedastrium chapalense* (S. Watson) Rose (1905); **incl.** *Sedum cordifolium* Sessé & Moçino (1894); **incl.** *Sedastrium rubricaule* Rose (1905) $\equiv$ *Sedum rubricaule* (Rose) Praeger (1921) $\equiv$ *Sedum ebracteatum* var. *rubricaule* (Rose) Fröderström (1936); **incl.** *Sedum barrancae* M. E. Jones (1935).

[1] **L** of flowering **Br** ovate to oblong, pubescent, 4 - 50 mm long; **Ha** simple.

S. ebracteatum ssp. **grandifolium** R. T. Clausen (CSJA 18: 86, fig. 53, 1946). **T**: Mexico, Guerrero (Hinton 14933 [CU]). – **D**: Mexico (Sierra Madre del Sur; known from the type locality only).

[1] **L** of flowering **Br** mostly elliptic-oblong, prominently ciliate and pubescent, 25 - 105 mm long; **Ha** sometimes branched.

S. ecalcaratum H. J. Wang & P. S. Hsu (Rheede 1(1-2): 46-48, ill., 1991). **T**: China, Zhejiang (*Lu* 17 [FUS?]). – **D**: E China (Zhejiang); $\pm$ 100 m.

[1] Perennial herbs with rooting, decumbent or ascending non-flowering shoots; **L** in whorls of 3 or 4, obovate-spatulate to obovate-lanceolate or linear to obovate-linear, emarginate or obtuse, cuneate, 10 - 28 $\times$ 2 - 5 (-10) mm; flowering **Br** suberect, with **L** alternate in the upper part, to 15 cm long; **Inf** many-flowered cymes with 3 to 4 cincinni; **Bra** linear; **Fl** 5-merous, subsessile; **Sep** unequal, linear, acute, 1.2 - 3.2 $\times$ $\pm$ 0.5 mm; **Pet** lanceolate, yellow, 5 - 5.5 $\times$ 1.2 - 1.4 mm; **Anth** red; **NSc** broadly cuneate to square; **Sty** $\pm$ 1 mm; **Fr** somewhat divergent, basally connate; **Se** oblong.

Belonging to the *S. sarmentosum* complex and close to *S. kiangnanense* and *S. jiulungshanense*.

S. edwardsii (R. T. Clausen) B. L. Turner (Phytologia 78(6): 406, 1995). **T**: Mexico, Tamaulipas (Clausen 80-20D [CU]). – **D**: Mexico (W Tamaulipas); limestone rocks, 900 - 1800 m. **Fig. XXXIX.e** $\equiv$ *Sedum rhodocarpum* ssp. *edwardsii* R. T. Clausen (1981).

[1] Differs from the closely related *S. rhodocarpum*: Stems, **L**, **Sep** and **Pet** pubescent; **L** rounded, dark green; **Pet** pale green with dense reddish speckles below the middle. – [U. Eggli]

S. elatinoides Franchet (Nouv. Arch. Mus. Hist. Nat., sér. 2, 6: 10, ill., 1883). **T**: China, Shaanxi (*David* s.n. [P]). – **D**: Myanmar to China (Gansu, Hubei, Shaanxi, Shanxi, Sichuan, NW Yunnan); wet moss-covered shaded boulders, 1200 - 3000 m. **I**: Fröderström (1931: 37, t. 21-22); Fu & Fu (1984: t. 19).

Incl. *Sedum silvestrii* Pampanini (1910); **incl.** *Sedum trientaloides* Praeger (1921); **incl.** *Sedum galioides* Franchet ex Hamet (1929) (*nom. inval.*, Art. 34.1c).

[2] Decumbent or erect probably annual herbs without sterile stems, stems simple or sometimes branched, 5 - 20 cm tall; **L** in whorls of 3 - 5; oblong, subobtuse, broadly petiolate, 8 - 20 mm; **Inf** lax panicles or subcorymbose, often long pedunculate; **Ped** to 4 $\times$ as long as the **Fl**; **Fl** 5-merous; **Sep** broadly sessile, narrowly triangular to semi-oblong, subacute, 1.5 - 2 mm; **Pet** broadly semi-oblong, acute, white, 2 - 4 mm; **NSc** broadly spatulate, deeply emarginate; **Fr** papillose; **Se** ovoid, costate.

S. elburzense Akhiani & Assadi (Iranian J. Bot. 8(2): 164-166, ill., 2000). **T**: Iran, Tehran (*Dini* 852 [TARI]). – **D**: Iran (Tehran, Azerbaidjan), 1500 - 1850 m.

[1] Annual herbs to 20 cm tall; stems simple below, branched above, glandular-hairy, 3.5 - 9.5 cm long; **L** alternate, linear or oblong, 6 - 20 $\times$ 2 - 4 mm, obtuse or rounded, $\pm$ glabrous; **Inf** corymbose, 10- to 30-flowered; **Fl** 5-merous; **Ped** 2 - 8 mm, glandular-hairy; **Sep** basally connate, 1.5 mm, triangular, acute; **Pet** linear-lanceolate or lanceolate, 2 - 4.5 mm, mucronate, yellow with purplish midvein; **St** $\frac{1}{2}$ as long as the **Pet**; **Anth** violet; **Fr** erect, glandular-hairy, purplish; **Se** numerous, oblong, brown, testa not described.

Compared with *S. nanum* in the protologue. It is said to differ by its larger size, the indumentum of the upper stem parts, and stamens as long as the petals or longer. In the English description, the length of the stamens is, however, given as $\frac{1}{2}$ the petal length. – [U. Eggli]

S. elrodii M. E. Jones (Bull. Montana State Univ., Biol. Ser. 15(61): 30, 1910). – **D**: USA (Montana).

[?] Tufted perennial herbs with fleshy horizontal **Rstock**; **Br** ascending, sparingly branched above, 10 - 14 cm tall; **L** closely set and appressed, ovate or oblong, obtuse, broadly spurred, thick, 5 - 12 mm; flowering **Br** erect; **Inf** cymes with few-flowered, monochasial **Br**; **Fl** 5-merous, sessile or subsessile; **Sep** ovate, obtuse, 1.5 - 2 mm; **Pet** basally connate, lanceolate, acuminate, bright yellow, ± 7 mm; **Fr** diverging.

Imperfectly known. Fröderström (1936a) considered it to be closely related to *S. divergens*, but Clausen (1975) regarded it as a naturalized form of the Eurasian *S. acre*, which seems hardly justified on account of the fleshy rootstock described in the protologue.

S. emarginatum Migo (J. Shanghai Sci. Inst. Sect. III, 3: 224, 1937). **T**: China, Zhejiang (*Migo* s.n. [TI iso]). – **D**: S, SE and E China; widespread, moist mountain habitats, 600 - 1800 m. **I**: Fu & Fu (1984: t. 33).

[1] Perennial herbs; **L** decussate, spatulate-obovate to broadly obovate, rounded or emarginate, 10 - 20 $\times$ 5 - 10 mm, attenuate with a short basal spur; flowering **Br** to 15 cm; **Inf** many-flowered bracteate cymes with 2 or 3 cincinni; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, unequal, lanceolate to narrowly oblong, to 5 mm, obtuse; **Pet** linear-lanceolate to lanceolate, obtuse or roundish, yellowish, 6 - 8 $\times$ 1.5 - 2 mm; **NSc** oblong, obtuse or rounded; **Fr** slightly divergent, with small lips along the ventral sutures; **Se** greyish-brown.

S. engleri Hamet (BJS 44(Beiblatt 101): 31, 1910). **T**: China, Yunnan / Sichuan (*Ducloux* 4457 [not located]). – **D**: China (SW Hubei, SW Sichuan, NW Yunnan); rocks on forested slopes, 1900 - 3600 m. **I**: Fröderström (1931: 93, t. 59-60).

Incl. *Sedum engleri* var. *forrestii* Hamet (1910); **incl.** *Sedum engleri* var. *dentatum* S. H. Fu (1980).

[1] Perennial herbs with slender or stout **Rstock**, sterile stems tiny, slender, leafy; **L** petiolate, lamina orbicular, oblong to ovate, sometimes wavy, (5-) 30 - 60 mm; flowering **Br** stout, roughened in the upper part, 20 - 30 cm; **Inf** many-flowered cymes with spreading cincinni elongating in **Fr**; **Fl** 5-merous, shortly pedicellate; **Sep** broadly sessile, unequal, broadly linear to ovate, 1.7 - 4 mm; **Pet** oblong to ovate, broadly mucronate, yellowish, 3.5 - 4 mm; **NSc** square or narrower; **Fr** widely spreading; **Se** oblong-ovoid, papillate.

The 2 additional subspecies described in the course of time are probably not closely related with this species. In contrast to typical *S. engleri*, var. *forrestii* has basally free and spurred sepals, whereas var. *dentatum* allegedly has dentate leaves and may either belong to *Hylotelephium* or *Phedimus*. Praeger (1921b) and Fröderström (1931) also noted a resemblance between the vegetative parts of *S. engleri* and *Hylotelephium*. None the less, Fu & Ohba

(2001: 251) upheld var. *dentatum* and place var. *forrestii* in the synonymy of the typical variety.

S. epidendrum Hochstetter ex A. Richard (Tent. Fl. Abyss. 1: 314, 1847). **T**: Ethiopia, Gondor Region (*Schimper* II.1291 [P, K, LE]). – **D**: Ethiopia; epiphytic, 2600 - 2700 m.

Incl. *Sedum schimperii* Britten (1871).

[2] Perennial glabrous shrubby epiphytes with erect or decumbent basally woody stems; **L** in whorls of 3, oblanceolate to suboblong, 20 - 27 mm; **Inf** few-flowered; **Ped** 5 - 7 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, triangular, ± 2 mm, subacute; **Pet** basally 0.5 - 0.7 mm connate, oblong, 5 - 7 mm, shortly mucronate, yellow; **Fl** yellow; **NSc** broadly linear-spatulate; **Sty** 4.5 - 6.5 mm; **Fr** erect; **Se** linear, 2 - 3 mm, dark brown, costate.

Closely related to *S. churchillianum* and *S. mooneyi*.

S. erici-magnusii Fröderström (Acta Horti Gothob. 15: 22-23, figs. 126-135, 1942). **T**: China, Sichuan (*Smith* 11431 [UPS ?]). – **D**: E Tibet, Cina (Gansu, Sichuan).

Incl. *Sedum magnusii* Hamet ex Fröderström (1942) (*nom. inval.*, Art. 34.1a).

[1] Tiny annual herbs with erect stems branching from the base; **L** alternate, oblong, tapering towards the subacute tip; **Inf** 1- or 2-flowered; **Bra** broadly lanceolate, subacute, to 2 mm; **Ped** 2 - 3 mm; **Fl** 4- or 5-merous; **Sep** basally free, shortly spurred, slightly unequal, oblong, long apiculate; **Pet** free at the broad base, semi-ovate, obtuse, pale yellow; **NSc** linear-filiform, obtuse, rose; **Sty** short; **Fr** suberect; **Se** subovoid, reticulate-papillose.

S. erici-magnusii ssp. *chilianense* K. T. Fu (Acta Bot. Boreal.-Occid. Sin. 11(2): 170-171, ill., 1991). **T**: China, Gansu (*Wang* 12865 [NW Inst. Bot. Shaanxi]). – **D**: China (W Gansu); slopes.

[1] **L** tips attenuate to acute, basally with an almost truncate spur; **Pet** tips obtusely cucullate.

The seeds are described as smooth in the protologue, which is at variance with the species description. – [U. Eggli]

S. erici-magnusii ssp. *erici-magnusii* – **D**: E Tibet, China (W Sichuan); pastures, gravelly places, sandy beaches, rock crevices, 3800 - 4900 m. **I**: Fröderström (1931: t. 37: 2, as *S. magnusii*).

[1] Plants ± 1 cm tall; **L** ± 2 mm; **Fl** 4- or 5-merous; **Sep** ± 3 mm; **Pet** ± 2 mm; **Ca** only 3; **Fr** ± 2 mm.

The original description erroneously gives the height of the sterile stems as 1 - 1.2 mm.

S. erici-magnusii var. *subalpinum* Fröderström (Acta Horti Gothob. 15: 23, figs. 136-144, t. 5: 3, 1942). **T**: China, Sichuan (*Smith* 11292 [UPS ?]). – **D**: China (Sichuan); ± 3800 m.

[1] Plants to 3 cm tall; **L** ± 4 mm; **Fl** 4-merous,

with the epipetalous 4 **St** only or without **St**; **Sep** 3.2 - 4 mm; **Pet** $\pm$ 3 mm; **Fr** $\pm$ 2.5 mm.

Treated as synonym of ssp. *erici-magnusii* by Fu & Ohba (2001).

S. eriocarpum Sibthorp & Smith (Fl. Graec. Prodr. 1: 310, 1809). **T:** [lecto - icono]: Sibthorp, Fl. Graeca 5: t. 449, 1825. - **Lit:** Jalas & al. (1999: 95). **D:** Greece, Aegean Region, Turkey (S Anatolia), Cyprus, Near East.

$\equiv$ *Sedum glaucum* var. *eriocarpum* (Smith) Boissier (1872) (*incorrect name*, Art. 11.4).

[2] Erect annual herbs, $\pm$ glandular-pubescent; **L** basally in whorls of 4, alternate above, broadly elliptic to linear, obtuse to subacute, glaucous; **Inf** terminal, usually densely glandular-pubescent, bracteate cymes with (1-) 2 - 3 (-5) cincinni; **Fl** 5-merous, sessile or shortly pedicellate; **Sep** broadly sessile, basally connate, equal, triangular, 1 - 1.5 mm, acute; **Pet** free, narrowly oblong or lanceolate to broadly ovate-elliptic, 4 - 7 mm, spreading, keel often red abaxially; **Fil** white, usually papillate at the base; **Anth** bright red, brick-red or purple, rarely yellow, to 1 mm; **NSc** square or oblong, often emarginate, white to yellow; **Sty** slender, 1 - 1.5 mm, white; **Fr** spreading, brown to purplish-brown, tuberculate; **Se** ovoid, shiny black or brown, costate.

A very variable species, in particular in Greece and the Aegean region. Several segregate taxa have been classified as species but given the variation of the discriminating characters, the subtlety of the differences, and our imperfect knowledge of the precise distribution of these taxa, the rank of subspecies seems more appropriate. The subspecies are fully interfertile and can be easily hybridized, though the fertility of the hybrids is sometimes (strongly) reduced.

S. eriocarpum ssp. *apertiflorum* 't Hart (Ot Sist. Bot. Dergisi 2(2): 7, 1996). **Nom. inval.**, Art. 37.6. **T:** Greece ('t Hart 25001 [not indicated]). - **D:** C and N Greece (Sterea Ellas, Pindos and Central-East, Makedonia, and North-East).

[2] Stems slender; **L** narrowly oblong to linear, subacute to obtuse, terete, to 20 mm, green or light green, glaucous; **Pet** lanceolate, usually intensely rose or pink; **Anth** bright red. - *Cytology*: $2n = 20$.

S. eriocarpum ssp. *caricum* (Carlström) 't Hart (Ot Sist. Bot. Dergisi 2(2): 8, 1996). **T:** Turkey, Mugla (Carlström 9694 [LD]). - **D:** Greece (Rhodos, East Aegean Islands), SW Turkey; serpentine.

$\equiv$ *Sedum caricum* Carlström (1985).

[2] Small, compact, almost glabrous or upper parts sparsely glandular-pubescent; **L** oblong to ovate-elliptic, obtuse, terete to subterete, to 15 mm, glaucous-green; **Inf** with 4 - 6 **Br**; **Pet** lanceolate to ovate-elliptic, white, often with reddish keel; **Anth** red or bright red. - *Cytology*: $2n = 20$.

S. eriocarpum ssp. *delicum* (Vierhapper) 't Hart (Ot Sist. Bot. Dergisi 2(2): 7, 1996). **T:** Greece (Watzl s.n. [WU]). - **D:** Greece (Aegean Region: Kiklades).

$\equiv$ *Sedum rubens* ssp. *delicum* Vierhapper (1919)

$\equiv$ *Sedum rubens* var. *delicum* (Vierhapper) Hayek (1925) $\equiv$ *Sedum delicum* (Vierhapper) Carlström (1985).

[2] Very much like ssp. *eriocarpum*; **L** light green; **Inf** with 3 - 7 **Br**; **Pet** usually broadly ovate-elliptic, white or pink; **Anth** bright red. - *Cytology*: $2n = 20$.

S. eriocarpum ssp. *epiroticum* (Baldacci) 't Hart (Ot Sist. Bot. Dergisi 2(2): 7, 1996). **T:** Greece, Prevesa (Baldacci s.n. [not located]). - **D:** Greece (Kefalonia, Ithaca and adjacent coastal regions).

$\equiv$ *Sedum annuum* ssp. *epiroticum* Baldacci (1898).

[2] **L** like ssp. *eriocarpum*; **Pet** pale yellow or cream-coloured; **Anth** yellow or red. - *Cytology*: $2n = 20$.

S. eriocarpum ssp. *eriocarpum* - **D:** Greece (Peloponnisos and adjacent islands).

[2] Stems usually stout; **L** oblong to narrowly elliptic, obtuse to rounded, semiterete to terete, $\pm$ 10 mm, often dark green, glaucous; **Fl** subsessile; **Pet** lanceolate to oblong, white, rose or pink; **Fil** glabrous or papillate; **Anth** dark red, sometimes pink or yellow. - *Cytology*: $2n = 20$.

S. eriocarpum ssp. *orientale* 't Hart (Ot Sist. Bot. Dergisi 2(2): 8-9, 1996). **Nom. inval.**, Art. 37.6. **T:** Israel (van Ham 39.1 [not indicated]). - **D:** Throughout the Near East: S Turkey, Lebanon, Syria, Israel, Jordania, Iraq, Iran.

Incl. *Sedum palaestinum* Boissier (1849); **incl.** *Sedum sanguineum* Boissier & Haussknecht (1872).

[2] Shoots slender, 10 cm or more; **L** oblong or narrowly elliptic to broadly linear, terete to semiterete; **Inf** usually with 2 or 3 **Br** (rarely more); **Pet** ovate-elliptic to lanceolate, white, often pink or rose-coloured; **Anth** bright red, brick-red, or brownish-red, rarely yellowish. - *Cytology*: $2n = 10, 12, 14, 16, 20$.

The type of ssp. *orientale* is a diploid plant ($2n = 10$). So far diploids have only been reported for Israel, but they may be distributed more widely. Plants with $2n = 12$ and $2n = 14$ occur in S Anatolia ('t Hart & Alpınar, unpublished data) and the cytotype with $2n = 16$ was reported from Israel. The origin and genetics of these aneuploid or dysploid cytotypes is still obscure.

Most probably *S. palaestinum* and *S. sanguineum* belong here. *S. palaestinum* is almost glabrous and allegedly has pale yellow petals. It was described from Israel (type: Palaestina, Mt. Carmel, Boissier s.n., 1846, G-BOIS). Additional specimens have been reported from Syria and the Lebanon. The

most distinguishing character of *S. sanguineum* is its intense red colour. It was described from Iraq (type: Mesopotamia, "in rup. calc. Ghebel Taktak", Haussknecht 401, 1867, G-Boiss).

S. eriocarpum ssp. **porphyreum** (Boissier) 't Hart (Ot Sist. Bot. Dergisi 2(2): 8, 1996). **T:** Cyprus (*Kotschy* 475 [W, G-BOIS]). – **D:** Cyprus. **I:** Stephenson (1993: 302, as *S. porphyreum*).

≡ *Sedum porphyreum* Kotschy (1865); **incl.** *Sedum porphyreum* var. *parviglandulosum* H. Lindberg (1946).

[2] Small, almost glabrous, usually tinged deep red; **L** narrowly elliptic to oblong-ovate, semiterete or almost flat, to 12 mm, glaucous; **Pet** white or pink, outside red; **Anth** dark purple. – *Cytology*: $2n = 20$.

S. eriocarpum ssp. **spathulifolium** 't Hart (Ot Sist. Bot. Dergisi 2(2): 7-8, 1996). **Nom. inval.**, Art. 37.6. **T:** Greece, Crete ('t Hart 27104 [not indicated]). – **D:** Greece (endemic to Crete); limestone.

[2] Sparsely glandular-pubescent; **L** spatulate or broadly elliptic, subacute, semiterete or almost flat, ± 10 mm, pale grey-green, glaucous; **Fl** subsessile to distinctly pedicellate; **Pet** narrowly lanceolate, white or rarely pinkish; **Anth** bright red or rarely yellow. – *Cytology*: $2n = 20$.

S. erythrospermum Hayata (Icon. Pl. Formos. 3: 110, 1913). **T:** Taiwan (*Mori* s.n. [TI]). – **D:** Taiwan, Philippines. **I:** Ying (1978: 2: 226).

[1] Fleshy annual herbs with slender stems, branching in the upper part, 8 - 12 cm tall; **L** obovate-spatulate, spatulate to linear-oblong, rounded or obtuse, obtuse or tapering at the base, 6 - 12 $\times$ 3 - 6 mm; **Fl** sessile; **Sep** basally free, unequal; **Pet** basally connate, lanceolate, narrowed to the truncate base, yellow, 3 - 5 mm, widely spreading; **Anth** yellow; **NSc** flat, narrowly oblong; **Sty** very short; **Fr** spreading; **Se** elongate, oblong, red, (reticulate-) papillate.

S. erythrospermum ssp. **australe** H. Ohba (J. Jap. Bot. 52(11): 322, 1977). **T:** Philippines, Luzon (*Elmer* 6568 [PNH 114365]). – **D:** Philippines (Luzon: Benguet Prov.); ledges and gravelly hillsides near mountain tops, 2000 - 2200 m.

Incl. *Sedum australe* Merrill (1905) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum ambiflorum* R. T. Clausen (1946).

[1] **L** mostly alternate; **Inf** trichotomously branching cymes; **Fl** 4-merous; **Sep** narrowly oblong-spatulate, rounded to subtruncate, slightly broadening towards the base, 2 - 4 $\times$ ± 1 mm; **Pet** acuminate. – *Cytology*: $2n = 134$ (as *S. ambiflorum*).

S. erythrospermum ssp. **erythrospermum** – **D:**

Taiwan; shady places in forests or under rocks, 2100 - 3500 m. **I:** Ying (1978: 2: 226); Tang & Huang (1989: 166).

Incl. *Sedum arisanense* Yamamoto (1926); **incl.** *Sedum brachyrhynchum* Yamamoto (1926).

[1] **L** mostly opposite or in whorls; **Inf** dichotomously branched cymes; **Fl** 5-merous; **Sep** narrowly oblong-ob lanceolate or linear, obtuse, narrowing to the truncate base, 2 - 2.5 $\times$ ± 0.5 mm; **Pet** acute.

S. euxinum 't Hart & Alpinar (Acta Bot. Neerl. 40: 357-361, 1991). **T:** Turkey, Rize (*Alpinar* & 't Hart AH504 [ISTE, U]). – **D:** NE Turkey (Anatolia), Armenia; endemic to the Pontic region; 1800 - 2650 m.

[1] Glabrous perennial herbs with long, trailing and rooting, procumbent or ascending, sparingly branched, non-flowering shoots of 2 - 3 mm $\varnothing$; **L** alternate, loosely imbricate or patent, sessile with a short truncate spur, elliptic-oblong, 4 - 6 $\times$ ± 1.6 mm, rounded, semiterete, shiny, bright green; flowering **Br** erect, 6 - 8 (-10) cm tall, usually simple or with small secondary axillary **Inf**; **Inf** cymes with (3-) 7 - 12 (-17) **Fl** on (1-) 2 (-3) monochasial **Br**; **Bra** 2 per **Fl**; **Fl** 5-merous, subsessile; **Sep** broadly sessile, unequal, oblong-elliptic, to 3 mm, obtuse; **Pet** free, elliptic, ± 5 mm, acute-acuminate, yellow; **Fil** yellow; **Anth** yellow; **NSc** oblong; **Sty** erect, ± 0.7 mm; **Fr** stellately patent, yellowish-brown, with pale narrow lips along the suture; **Se** ovoid, brown, reticulate-papillose. – *Cytology*: $2n = 48$.

Belonging to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. farinosum Lowe (Prim. Faun. Fl. Mader. 31, 1831). – **D:** Madeira; endemic, 1600 - 2000 m. **I:** 't Hart (1999a).

≡ *Oreosedum farinosum* (Lowe) Grulich (1984).

[1] Glabrous strongly pruinose perennial herbs with creeping and rooting or ascending, laxly branched non-flowering stems, often reddish, sometimes basally slightly woody; **L** alternate, laxly imbricate, sessile with a short broad basal spur, ovoid to oblong, 3 - 6 mm, obtuse, semiterete, strongly pruinose, dark grey-green to whitish; flowering **Br** ascending, to 8 cm tall; **Inf** small cymes with 2 - 4 cincinni; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile; **Sep** basally free, spurred, unequal, oblong, to ± 4 mm, obtuse or subacute, pruinose; **Pet** free, oblong, to 7 mm, acuminate, white, outside sometimes tinged red; **Fil** white; **Anth** oblong, red; **NSc** spatulate, red; **Sty** long, white; **Fr** stellately patent, dark reddish-brown, with 2 distinct lips along the suture; **Se** ovoid, brown, reticulate-papillose. – *Cytology*: $2n = \pm 384$.

Closely related to Ser. *Anglica* 't Hart, though all attempts to hybridize it with *S. anglicum* and *S. arenarium* have failed so far. – [H. 't Hart]

S. feddei Hamet (RSN 8: 25-27, 1910). **T:** China, Sichuan (*Soulié* 112 [P]). – **D:** China (W Sichuan). **I:** Fröderström (1931: 48, t. 29).

[1] Probably annual herbs with ascending stems much branched from the base, 8 - 12 cm tall; **L** alternate, broadly triangular to ovate, acute, 7 - 9 mm, with a slightly trilobate spur; **Inf** lax corymbs; **Fl** 5-merous; **Sep** basally free, shortly spurred, oblong, acute, 6 - 7 mm; **Pet** connate for up to 1.4 mm, oblong, rather long mucronate, yellowish, 9 - 11 mm; **NSc** linear-spatulate, emarginate; **Fr** erect.

S. fedtschenkoi Hamet (Russk. Bot. Zhurn. 1914 (1): 2-4, 1914). **T:** Tibet (*Walton* s.n. [LE]). – **D:** E Tibet; China (S Qinghai, W Sichuan); meadows near rivers, lake banks, rocks, steppes; 3300 - 4800 m. **I:** Fröderström (1931: t. 35).

[1] Annual or biennial herbs with ascending stems, branched from the base, 2.5 - 4.5 cm tall; **L** alternate, linear-lanceolate, acute, 4.5 - 8 mm; **Sep** basally free, shortly spurred, lanceolate to subobovate, acute, 3 - 5 mm; **Pet** suboblong, shortly mucronate, white or yellowish, $\pm$ 4 mm; **NSc** subteretespate, emarginate; **Fr** erect, few-seeded; **Se** minutely reticulate-papillose.

S. filipes Hemsley (JLSB 23: 284, t. 7: A, 1887). **T:** China, Hubei (*Henry* s.n. [K]). – **D:** W Himalaya (India, Nepal, Sikkim, Bhutan) to C China (Sichuan, Hubei); forested slopes, 800 - 2000 m. **I:** Fröderström (1931: 35, t. 19).

Incl. *Sedum filipes* var. *genuinum* Hamet (1913) (*nom. inval.*, Art. 24.3); **incl.** *Sedum pseudostapfii* Praeger (1921) $\equiv$ *Sedum filipes* var. *pseudostapfii* (Praeger) Fröderström (1931).

[2] Annual or biennial herbs with erect or ascending stems, to 30 cm tall; **L** few, opposite or in whorls of 4, ovate or obovate to (sub-) orbicular, obtuse, petiolate, 5 - 45 $\times$ to 40 mm; **Inf** densely corymbose cymes, often with long-pedunculate secondary cymes from the **L** axils; **Ped** 2 - 3 $\times$ as long as the **Fl**; **Fl** 5-merous; **Sep** broadly sessile, triangular or semi-oblong, obtuse to rounded, 1 - 1.5 mm; **Pet** basally connate, broadly semi-oblong, subobtuse, white or reddish, 3 - 4 mm; **NSc** broadly linear-spatulate; **Fr** suberect; **Se** smooth.

S. pseudostapfii was described from cultivated material and Fröderström (1931) included it in *S. filipes* as var. *pseudostapfii*, said to differ from the typical variety by shorter pedicels (as long as or slightly longer than the flowers) and much broader sepals, but Grierson & Long (1987) sank it into the synonymy of the species.

S. fischeri Hamet (Russk. Bot. Zhurn. 1914(1): 1-2, 1914). **T:** Sikkim (*Smith & Cave* 2350 [LE, J]). – **D:** NW India, Sikkim, Bhutan, S Tibet, China (E Qinghai); meadows and rock crevices on slopes, 3600 - 5600 m. **I:** Fröderström (1931: 59, t. 35).

[1] Annual or biennial herbs with ascending, usu-

ally simple or branched stems, 2.5 - 5 cm tall; **L** alternate, oblanceolate or spatulate, obtuse or subacute, 4 - 5 $\times$ 1 - 1.5 mm; **Inf** lax corymbs; **Fl** 5-merous with 5 **St** only; **Sep** broadly sessile, oblong, (sub-) acute, 2 - 4 $\times$ 0.5 - 1.5 mm; **Pet** free at the base, lanceolate, acuminate, with obtuse tips, white, 3 - 4.5 mm; **NSc** narrowly linear-subspatulate, obtuse; **Fr** erect, 3- to 7-seeded; **Se** reticulate-papillose.

S. flaccidum Rose (CUSNH 13(9): 298, 1911). **T:** Mexico, Durango (*Palmer* 513 [US 571538, UC]). – **D:** Mexico (Durango). **I:** Fröderström (1936a: 127, t. 87).

[1] Small glabrous perennial herbs with short napiform often branched **R**; **L** alternate, oblong, obtuse, broadly spurred, turgid, 5 - 10 mm; flowering **Br** suberect or drooping, diffusely branching from or near the base, **Br** very weak and slender; **Inf** very lax and elongated panicles; **Fl** 5-merous, long pedicellate; **Sep** basally free, shortly spurred, unequal, lanceolate to subovate, obtuse, green, 5 - 6 mm; **Pet** nearly free to the base, ovate, obtuse, broadly mucronate, white, $\pm$ banded with red, $\pm$ 6 mm; **NSc** large, broadly linear-subspatulate, obtuse to slightly emarginate; **Fr** stellate, very turgid, purple; **Se** subovoid, reticulate. – *Cytology*: $2n = 22$.

S. formosanum N. E. Brown (Gard. Chron., ser. nov. 24: 134, 1885). **T:** Taiwan (*Ford* 19 [K]). – **D:** Taiwan, Japan (Oshima Island, Ryukyu, Kyushu), N Philippines (Batan Islands), probably S Korea; rocks at the shore, rarely inland. **I:** Tang & Huang (1989: 168); Tang & Huang (1993: 24).

Incl. *Sedum lochoense* Makino & Kuroiwa (1900) (*nom. inval.*, Art. 32.1c); **incl.** *Sedum mariae* Hamet (1910); **incl.** *Sedum taiwanianum* auct. (1972) (*nom. illeg.*, Art. 52.1).

[1] Annual tufted herbs with erect or arcuate, di- or trichotomously branched, densely leafy, rather stout stems, to (15-) 20 cm tall; **L** alternate, sometimes whorled, spatulate to obovate, rounded to obtuse, 10 - 20 $\times$ 8 - 12 mm; **Inf** rather large many-flowered cymes; **Bra** L-like; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, unequal, linear-lanceolate to spatulate-subovate, rounded to obtuse, 3.5 - 5 mm; **Pet** semi-oblong, broadly submucronate, yellow, 5 - 7 mm; **Anth** yellow; **Sty** $\pm$ 1 mm; **Fr** slightly divergent; **Se** papillose. – *Cytology*: $2n = 64, 66$.

Close to *S. alfredii* and included under that species by Fu & Fu (1984). It is hapaxanth like *S. alfredii* and sometimes perennating (Ohba 1982c: 559).

S. forreri Greene (Pittonia 1: 154, 1887). **T:** Mexico, Durango (*Forrer* s.n. [GH]). – **D:** Mexico (Durango: Sierra Madre Occidental); $\pm$ 2700 m. **I:** Fröderström (1936a: 125, t. 83).

Incl. *Sedum divergens* Greene (s.a.) (*nom. illeg.*, Art. 53.1).

[1] Glabrous small herbs with short **R** and erect stems, probably annual, simple below and much-branched above, 5 - 8 cm; **L** alternate, oblong to ovate, obtuse, broad and shortly spurred, 3 - 5 mm; **Inf** few-flowered, corymb-like; **Bra** lanceolate to oblong, $\pm$ 3 mm; **Fl** 5-merous, subsessile; **Sep** basally free, rather long spurred, unequal, suboblong, obtuse, $\pm$ 3 mm, spreading; **Pet** basally slightly connate, oblong, obtuse, broadly mucronate, whitish, 4 - 5 mm, spreading; **NSc** substipitate-spatulate, emarginate, thick; **Fr** suberect, few-seeded; **Se** ovoid, reticulate-papillose. – *Cytology*: $2n = 16$.

S. forrestii Hamet (Notes Roy. Bot. Gard. Edinburgh 5(24): 118-119, t. 86, 1912). **T**: China, Yunnan (*Forrest* 2808 [E]). – **D**: China (NW Yunnan); grasslands, exposed rocks, slopes, 3300 - 4000 m. **I**: Fröderström (1931: 71, t. 37); Fu & Fu (1984: t. 27).

[1] Annual or biennial herbs with ascending stems, branched from the base, 5 - 7 cm tall; **L** alternate, oblong to semi-ovate, 4.5 - 10 mm; **Fl** 5-merous, long pedicellate; **Sep** basally free, shortly spurred, often unequal, oblong to ovate, 3.5 - 6 mm; **Pet** oblong to broadly ovate, rounded to obtuse, 4 - 6 mm; **NSc** linear-subspatulate, to 2 mm; **Sty** rather long; **Fr** erect, few-seeded; **Se** minutely reticulate-papillose.

S. forsterianum Smith (in J. E. Smith & Sowerby, Engl. Bot. 26: t. 1802, 1808). **T**: England, Wales (*Anonymus* s.n. [not located]). – **Lit**: 't Hart (1978). **D**: NW and SW Europe (Belgium, Netherlands, Great Britain, Ireland, France, Germany, Luxembourg, Spain, Portugal incl. Açores), NW Africa (Morocco).

$\equiv$ *Sedum rupestre* ssp. *forsterianum* (Smith) R. L. Evans (1983) (*nom. inval.*, Art. 33.2) $\equiv$ *Petrosedum forsterianum* (Smith) Grulich (1984); **incl.** *Sedum pruinaum* auct. (s.a.) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum elegans* Lejeune (1811) $\equiv$ *Sedum forsterianum* ssp. *elegans* (Lejeune) hort. (s.a.) $\equiv$ *Sedum rupestre* ssp. *elegans* (Lejeune) Hegi & Em. Schmid (1922) $\equiv$ *Petrosedum rupestre* ssp. *elegans* (Lejeune) Velayos (1989); **incl.** *Sedum aureum* Wirtgen ex Schultz (1844) $\equiv$ *Sedum rupestre* var. *aureum* (Wirtgen ex Schultz) Wirtgen (s.a.) $\equiv$ *Sedum reflexum* var. *aureum* (Wirtgen) H. Jacobsen (1973); **incl.** *Sedum lejeunianum* Hornung ex Koch (1857); **incl.** *Sedum trevirense* Rosbach (1857); **incl.** *Sedum juranum* Gay (1863).

[1] Glabrous perennials; non-flowering shoots procumbent, rooting, with the **L** aggregated into cone-like terminal **Ros**; **L** densely imbricate, linear, mucronate, semiterete or flattened, with a truncate basal spur, 10 - 15 mm, green or glaucous; dead **L** persistent, brown; flowering **Br** ascending, 10 - 40 cm; **Inf** terminal corymbs with 3 - 7 monochasial

Br, globose and drooping in bud, with strongly recurved **Br**; **Bra** absent; **Fl** (5- to) 7- (to 9-) merous, shortly pedicellate; **Sep** basally connate, equal, triangular, acute-mucronate, 2 - 3 mm; **Pet** free, oblong, yellow, 6 - 8 mm, spreading; **Fil** yellow, glabrous; **Anth** yellow; **NSc** transversely oblong, yellowish-green; **Fr** erect, brown; **Se** oblong, pale brown, costate. – *Cytology*: $2n = 24, 48, 60, 72, 96$.

S. fragrans 't Hart (Bot. Helv. 93(2): 269-280, ill., 1983). **T**: France, Alpes Maritimes ('t Hart 26010 [U]). – **D**: SE France (Alpes Maritimes), NW Italy (Piemont).

[1] Fragile densely glandular-pubescent rosulate perennials producing short axillary stolons with small terminal **Ros**; **L** alternate, flat, spatulate or pseudopetiolate with a circular to broadly elliptic lamina, sometimes subsessile, to $15 (-20) \times \pm 8$ mm, obtuse or rounded, green or more often reddish; flowering **Br** erect or ascending, usually simple, to 20 cm; **Inf** usually lax and few-flowered cymes with 1 - 2 cincinni; **Ped** (4-) 7 (-9) mm; **Fl** 5-merous, (5-) 6 (-7) mm $\varnothing$, reflexed before anthesis; **Sep** broadly sessile, slightly unequal, linear-oblong to elliptic or triangular-ovate, $1 - 2 \times 0.5 (-1)$ mm; **Pet** basally connate for 0.8 - 1.4 mm, lobes broadly ovate to cordate, (2-) $2.5 (-3.5) \times (1.7-) 2.2 (-3.5)$ mm, long acuminate, white; **Fil** white; **Anth** red; **NSc** spatulate, red; **Sty** 0.7 mm; **Fr** erect, whitish; **Se** black or dark brown, shiny, costate. – *Cytology*: $2n = 20$.

Closely related to the vicariant *S. alsinefolium* (Ser. *Alsinefolia*), which is endemic to the Piemont (Italy). Artificial hybrids between the 2 species are sterile.

S. franchetii Grande (Bull. Orto Bot. Regia Univ. Napoli 4: 364, 1914). **T**: P. – **D**: China (NW Yunnan); thickets, rocks and cliffs, 2800 - 4100 m. **I**: Fröderström (1931: 63, t. 36).

Incl. *Sedum tenuifolium* Franchet (1894) (*nom. illeg.*, Art. 53.1).

[1] Annual or biennial herbs with erect stems, branched from the base, 10 - 20 cm tall; **L** alternate, linear-lanceolate, subacute, 5 - 10 mm, shortly spurred; **Fl** 5-merous; **Sep** basally free, shortly spurred, slightly unequal, lanceolate to oblong, subacute to subobtuse, 3.8 - 5 mm; **Pet** basally slightly connate, lanceolate, broadening at the base, obtuse to acute, subunguiculate, pale yellow, 4 - 4.5 mm; **NSc** narrowly linear, to 2 mm; **Fr** erect; **Se** reticulate-papillose.

S. frutescens Rose (CUSNH 13(9): 298, 1911). **T**: Mexico, Morelos (*Pringle* 13266 [US 462340, L]). – **D**: Mexico (Trans-Mexican Volcanic Belt); S slopes. **I**: Fröderström (1936a: 22, t. 13); Clausen (1959: 127). **Fig. XXXV.d**

[1] Perennial shrubs with stout stems with papery flaking bark and papillose twiglets; **L** alternate,

elliptic-linear or -oblong, acute, sometimes oblanceolate-oblong and obtuse, rarely subemarginate, subterete, finely papillose marginally, $14 - 58 \times 3 - 9$ mm; **Inf** cymes with 2 or more **Br**, laxly paniculate; **Fl** 5- (to 6-) merous, sessile or subsessile; **Sep** basally free, shortly spurred, unequal, oblong, obtuse, green, $2.1 - 4.1 \times 0.8 - 1.2$ mm, erect; **Pet** free near to the base, lanceolate to suboblong, subobtuse to acute, mucronate, carinate, white, with pale green or pink keel, ± 6.5 mm, spreading; **Anth** red, subglobose; **NSc** spatulate or obovate, emarginate, erose, white; **Sty** rather long, ± 5 mm; **Fr** widely divergent, with small lips along the ventral suture; **Se** lanceolate, reticulate. – *Cytology*: $2n = 60$.

S. fui G. D. Rowley (Nation. Cact. Succ. J. 28(1): 6, 1973). **T**: China, Yunnan (Wang 69840 [PE ?]). – **D**: China (Sichuan, Yunnan).

Incl. *Sedum platyphyllum* S. H. Fu (1951) (*nom. illeg.*, Art. 53.1).

[1] Annual herbs, branching from the base, 6.5 - 14 cm tall; **L** alternate or almost opposite, obovate-oblanceolate, sparse, obtuse, $12 - 18 \times 1.5 - 5$ mm, spurred; **Inf** many-flowered corymbs; **Bra** small, **L**-like; **Ped** to 2 mm; **Fl** 5-merous; **Sep** broadly sessile, linear or spatulate, acute; **Pet** lanceolate, yellowish-green, $5 - 6.2 \times \pm 1.1$ mm; **NSc** linear, cuneate or obtuse; **Sty** 0.6 - 0.7 mm; **Fr** basally connate; **Se** ovoid, reticulate-papillose.

S. fui var. **fui** – **D**: China (S Sichuan, W Yunnan); on rocks in forests and grassland, 3700 - 3800 m. **I**: Fu & Fu (1984: t. 20).

[1] **Sep** $2.2 - 4.5 \times 0.7$ mm; epipetalous **Fil** fused to the **Pet** for ± 1.7 mm; **NSc** 0.6 - 0.8 mm.

S. fui var. **longisepalum** (K. T. Fu) S. H. Fu (Fl. Reipub. Popul. Sin. 34(1): 86, 1984). **T**: China, Yunnan (*Chung-tien Exped.* 3967 [KUN]). – **D**: China (NW Yunnan); rocks at forest margins, ± 3500 m.

$\equiv$ *Sedum platyphyllum* var. *longisepalum* K. T. Fu (1974) (*incorrect name*, Art. 11.4).

[1] **Sep** $6.5 - 7 \times 1.2 - 2$ mm; epipetalous **Fil** fused to the **Pet** for up to 2.5 mm; **NSc** 0.8 - 0.9 mm.

S. furfuraceum Moran (CSJA 33(4): 103-105, ill., 1961). **T**: Mexico, San Luis Potosí (Moran & Kimnach 7659 [SD 51098]). – **D**: Mexico (San Luis Potosí); rocks on pine-covered hillsides, ± 2100 m.

[1] Glabrous perennial herbs with prostrate to ascending, sparsely branching stems, densely papillose near the tips, flattened at each node, 5 - 15 cm tall, growing sympodially past the terminal old **Inf**; **L** in whorls of 5, subtriquetrous-ovoid, obtuse, with margins and keels as obvious ridges, with tiny **Sc** on the surface, $6 - 11 \times 4.5 - 6$ mm, 4 - 5 mm thick; flowering **Br** erect; **Inf** sessile with 1 - 3 **Fl**; **Bra** elliptic-oblong, obtuse, subtriquetrous, ± 3.5 mm; **Ped** $\pm$

1 mm, irregularly rugose-papillose; **Fl** 5-merous; **Sep** unequal in width, elliptic-ovate, obtuse to rounded, subterete, with somewhat flaky cuticle, $2 - 2.5 \times 1 - 2$ mm, ascending, appressed to the **Cl**; **Pet** basally connate, broadly lanceolate, acute, canaliculate, ± 4.5 mm, whitish to purplish-red; **Fil** white; **Anth** light red; **NSc** subquadrate, yellowish, minutely dotted with red; **Fr** erect, with lips along the ventral suture, reddish; **Se** narrowly obovoid, reddish brown, reticulate-papillose. – *Cytology*: $2n = 68$.

S. fuscum Hemsley (Biol. Centr.-Amer., Bot. 1: 395, 1880). **T**: Mexico, San Luis Potosí (Parry & Palmer 235 [US]). – **D**: Mexico (San Luis Potosí). **I**: Fröderström (1936a: 124, t. 85).

$\equiv$ *Altamiranoa fusca* (Hemsley) Rose (1903) $\equiv$ *Villadia fusca* (Hemsley) H. Jacobsen (1958).

[1] Annual or biennial herbs with slender erect stems, simple at the base, branching above, to 10 cm tall; **L** alternate, oblong, obtuse, long and broadly spurred, 5 - 6 mm; flowering **Br** erect; **Inf** elongated cymes; **Bra** subovate, obtuse, ± 3.5 mm; **Fl** 5-merous, subsessile; **Sep** basally free, long spurred, slightly unequal, oblong, obtuse, ± 3 mm; **Pet** basally slightly connate, subobovate, obtuse, white, ± 4 mm; **NSc** narrowly stipitate, spatulate at the tip, rounded; **Fr** substellate; **Se** ovoid, reticulate-papillose.

S. fusiforme Lowe (Prim. Faun. Fl. Mader. 31, t. 3: fig. 1, 1831). – **D**: S Madeira; cliffs, to 500 m. **I**: 't Hart (1999a).

[1] Glabrous subshrubs to 20 cm tall, with much-branched shoots ascending from a stout (to 1 cm $\varnothing$) woody basal stem; **L** alternate, sessile, crowded at the stem tips, elliptic to oblong, 5 - 10 mm, subacute, terete, green or greyish-green with a dark red longitudinal stripe; flowering **Br** ascending or erect, to 8 cm, sparingly leafy; **Inf** lax few-flowered cymes with 2 (-3) cincinni; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile; **Sep** basally free, spurred, unequal, triangular-ovate, to 3 mm; **Pet** basally connate for 1.5 mm, ovate, 7 - 9 mm, acuminate, yellow mottled or spotted with red on the inside; **Fil** yellow; **Anth** yellow; **NSc** subspatulate-square, emarginate; **Fr** stellately patent, brown, with distinct pale lips along the suture; **Se** ovoid, brown, reticulate-papillose. – *Cytology*: $2n = 24$.

Belonging to the comparison of Ser. *Macaronesia* Fröderström. – [H. 't Hart]

S. gagei Hamet (RSN 8: 263-265, 1910). **T**: Sikim (*Smith & Cave* 2444 [CAL, Herb. Hamet]). – **D**: Nepal, Bhutan, Sikkim, India (Kumaon, Chumbi), Tibet; alpine rocks, 3950 - 5000 m. **I**: Fröderström (1931: 45, t. 30).

[1] Perennial herbs with decumbent stems, 5 - 10 cm; **L** alternate, linear-lanceolate, acuminate, with a somewhat trilobate spur, papillose and minutely

denticulate or ciliate-dentate along the margin, 4 - 6 mm; flowering **Br** suberect, usually simple, 4 - 6 cm; **Inf** dense few-flowered corymbs; **Fl** 5-merous; **Sep** basally free, shortly spurred, semi-oblong, acuminate, papillose, 4 - 7 mm; **Pet** free at the base, suboblong or elliptic, distinctly mucronate, broadly clawed, yellowish, 6 - 9 mm; **NSc** unguiculate-spatulate, emarginate; **Fr** erect; **Se** probably reticulate.

S. gattefossei Battandier & Jahandiez (Bull. Soc. Hist. Nat. Afr. Nord 12: 26, 1921). – **D:** Morocco. **I:** Maire (1977: 388).

≡ *Aichryson gattefossei* (Battandier & Jahandiez) Bramwell (1968) ≡ *Oreosedum gattefossei* (Battandier & Jahandiez) Grulich (1984).

[2] Glabrous annual herbs with erect stems to 18 cm tall, simple or branched in the upper part; **L** alternate, sessile, subterete or semiterete, linear-oblong, obtuse, 2.5 × 2 mm; **Inf** lax cymes with 2 or more **Br** (cincinni); **Bra** small or absent; **Ped** filiform, 4 - 8 mm; **Fl** 6-merous, ovoid or subglobular in bud; **Sep** broadly sessile, basally connate, semi-orbicular or broadly ovate, ± 1 mm, obtuse; **Pet** basally slightly connate, lanceolate or ovate-lanceolate, ± 3 mm, acuminate, yellow; **Fil** yellow, glabrous; **Anth** yellow; **NSc** obovate-cuneate, emarginate; **Fr** erect, basally densely papillate; **Se** ovate-oblong, brown, costate.

Close to *S. pubescens* and *S. versicolor*. The 3 species have been classified in Ser. *Pubescens* (Mes 1995b). The series *Caerulea*, *Monanthoideae* and *Pubescens* are the stem-groups of a lineage that eventually gave rise to the "Macaronesian *Sempervivoideae*", i.e. *Aeonium*, *Aichryson* and *Monanthes*.

S. gajae Hamet (RSN 8: 313-315, 1910). **T:** China, Sichuan (*Soulié* s.n. [P]). – **D:** China (W Sichuan); rocks in valleys, trailsides, 2600 - 3000 m. **I:** Fröderström (1931: 91, t. 57).

[1] Perennial herbs with short sterile stems to 2 cm; **L** alternate, oblong, obtuse, pubescent, 5 - 7.5 mm; flowering **Br** erect, pubescent, 5 - 10 cm; **Fl** 5-merous; **Sep** broadly sessile, triangular to semi-ovate, obtuse, pubescent, 2.5 - 3 mm; **Pet** broadly oblong, shortly mucronate, yellowish, ± 5 mm; **NSc** square-spatulate, small; **Fr** erect or suberect, with lips along the sutures.

S. glabrum (Rose) Praeger (J. Roy. Hort. Soc. 46: 127, 1921). **T:** Mexico, Coahuila (*Palmer* 585 [US]). – **D:** Mexico (Coahuila: Saltillo; San Luis Potosí), ± 2000 m. **I:** Fröderström (1936a: 78, t. 51-52).

≡ *Sedastrum glabrum* Rose (1905); **incl.** *Sedastrum palmeri* Rose in sched. (s.a.); **incl.** *Sedastrum turgidum* Rose in sched. (s.a.).

[1] Glabrous perennial herbs with *Sempervivum*-like basal **Ros**; **L** imbricate, alternate, oblanceolate to spatulate-oblong, broadly apiculate, 20 - 35 mm;

L on flowering **Br** oblong to ovate, very obtuse or shortly apiculate, shortly spurred, half-clasping, 10 - 30 mm; flowering **Br** erect or suberect, rather stout, densely leafy, 15 - 25 cm; **Inf** elongated panicles; **Fl** 5-merous, sessile; **Sep** broadly sessile, basally connate, slightly unequal, semiovate, obtuse, 2.5 - 3 mm, erect; **Pet** almost free to the broad base, broadly ovate, obtuse, erose, shortly mucronate, white with purple lines, ± 4.5 mm, suberect; **Anth** reddish; **NSc** broadly conical, obtuse, thickened at the tip; **Sty** rather short and erect; **Fr** densely mammillate, streaked and dotted with purple; **Se** lanceolate, reticulate. – *Cytology*: 2n = 62, 124.

S. glaebosum Fröderström (Acta Horti Gothob. 15: 16-17, figs. 75-82, t. 2: 4, 1942). **T:** China, Sichuan (*Smith* 11897 [UPS ?]). – **D:** Tibet, China (SE Quinhai, W Sichuan); rocks on slopes, ravines, 3500 - 5000 m. **I:** Fu & Fu (1984: t. 25).

[1] Perennial herbs with numerous tufts of small sterile stems to 2 cm; **L** alternate, densely imbricate, ovate to broadly lanceolate, acuminate, with short obtuse to bilobate spur and sparsely and shortly ciliate margins, 3 - 6 mm; flowering **Br** glabrous, erect, branched in the upper part, ± 6 cm; **Inf** lax few-flowered corymbs; **Bra** lanceolate, sparsely ciliate; **Fl** 5-merous, subsessile; **Sep** basally free, shortly spurred, subovate, with ciliate margins, ± 4 mm; **Pet** free, broadly lanceolate, narrowing towards the base, long mucronate, yellow, ± 7 mm; **NSc** basally lanceolate, spatulate above the middle, emarginate; **Sty** long; **Fr** erect, basally connate for 2.5 mm.

S. glaucophyllum R. T. Clausen (CSJA 18(4): 60-61, ill., 1946). **T:** USA, Virginia (*Dyal* s.n. [CU]). – **D:** USA (North Carolina to Maryland: Appalachian Highlands, endemic); shady places. **I:** Clausen (1975: 123).

[2] Caespitose perennial herbs with creeping and rooting much-branched stems; **L** alternate, oblanceolate to spatulate, with obtuse papillose tips, flat, base petiole-like, 6.5 - 17.8 × 2.2 - 4.5 mm, pale green or blue-green; flowering **Br** erect, 3.7 - 17.5 cm; **Inf** cymes with 3 **Br**; **Bra** L-like but smaller; **Fl** 4-merous, sessile; **Sep** broadly sessile, free, unequal, linear-lanceolate, tip obtuse and papillose, subterete, 3.6 - 6.3 × 0.9 - 1.6 mm, green, divergent; **Pet** free, lanceolate, acuminate, minutely hooded, white, ± 6.5 mm; **Fil** white; **Anth** dark red; **Sty** 0.8 - 1.7 mm; **NSc** subquadrate, truncate, white; **Fr** basally slightly connate, widely divergent, with lips along the ventral suture, brown; **Se** pear-shaped, yellow-brown, costate. – *Cytology*: 2n = 28, 44, 44 - 49, ± 46.

S. nevii (incl. *S. beyrichianum*) is clearly of the same affinity as this taxon and the 2 might represent synonyms. Clausen (1975) describes 3 races:

1. Lax **Ros** consisting of long green **L**. Growing on sandstone and gneiss above 1000 m.

2. Compact **Ros** consisting of glaucous **L**. Growing on limestone cliffs along rivers.

3. Like 1, but with smaller **L** and shorter **Pet**.

S. globuliflorum R. T. Clausen (Bull. Torrey Bot. Club 106: 212-213, ills., 1979). **T:** Mexico, Hidalgo (Clausen 78-13 [CU]). – **D:** Mexico (Hidalgo).

[1] Perennial herbs with prominent **Ros**; **L** spatulate, ciliate, $\pm 8 \times 3$ mm; flowering **Br** erect, to 4 cm; **L** oblanceolate, ciliate, speckled with red at the base, $5 - 7 \times 2 - 3$ mm; **Inf** cymes with 2 - 3 **Br**; **Fl** 5-merous; **Sep** ovate-elliptic, ciliate, $2.8 - 3.6 \times 1.5 - 2$ mm; **Pet** basally connate, oblanceolate-oblong, mucronate, colour not described; **Fil** white; **Anth** yellow; **NSc** obdeltoid, yellow; **Sty** very short or absent; **Fr** erect, sulcate; **Se** ellipsoid, reticulate-papillose.

S. glomerifolium M. G. Gilbert (Bradleya 3: 49, ill. (p. 51), 1985). **T:** Ethiopia, Bale Region (*S. Gilbert* 100 [UPS, ETH, K]). – **D:** Ethiopia (Bale Region).

[2?] Glabrous rosulate perennial herbs producing very slender **L**-less stolons with small terminal **Ros**; **L** alternate, sessile, ovoid to spatulate, terete to semiterete, ± 5 mm, obtuse, pale greyish-green; flowering **Br** to 5 cm; **Inf** cymose, with 1 or 2 monochasial **Br**; **Bra** **L**-like; **Ped** to 3.5 mm; **Fl** 4-merous; **Sep** broadly sessile, basally slightly connate, to 1 mm; **Pet** oblong-ovate, 1.5 - 2.5 mm, subacute, white; **Fil** ± 1.6 mm, white; **Anth** dark red or brownish; **Sty** 0.4 mm; **NSc** narrowly oblong-spatulate, tip slightly emarginate; **Fr** 1- or 2-seeded, prominently papillate, circumscissile and breaking off at the base; **Se** obovoid, 1.3 mm, dark brown, costate.

S. goldmanii (Rose) Moran (Haseltonia 4: 46, 1996). **T:** Mexico, Michoacán (*Goldman* s.n. [US]). – **Lit:** Moran (1998c: with ills.). **D:** Mexico (Guanajuato, Hidalgo, México, Michoacán, Morelos, Puebla, Tlaxcala); mountain regions, mostly on rocks, 2000 - 4500 m.

$\equiv$ *Altamiranoa goldmanii* Rose (1903) $\equiv$ *Villadia goldmanii* (Rose) A. Berger (1930); **incl.** *Cotyledon batesii* Hemsley (1878) $\equiv$ *Altamiranoa batesii* (Hemsley) Rose (1903) $\equiv$ *Villadia batesii* (Hemsley) Baehni & Macbride (1937); **incl.** *Umbilicus mexicanus* Schlechtendal (1880) $\equiv$ *Cotyledon mexicana* (Schlechtendal) Hemsley (1880) $\equiv$ *Altamiranoa mexicana* (Schlechtendal) Rose (1905) $\equiv$ *Villadia mexicana* (Schlechtendal) H. Jacobsen (1958); **incl.** *Altamiranoa batesii* var. *subalpina* Fröderström (1935) $\equiv$ *Villadia batesii* var. *subalpina* (Fröderström) G. D. Rowley (1958); **incl.** *Altamiranoa alpina* Fröderström (1936) $\equiv$ *Villadia alpina* (Fröderström) H. Jacobsen (1958); **incl.** *Altamiranoa ramulosa* Fröderström (1936) $\equiv$ *Villadia ramulosa* (Fröderström) H. Jacobsen (1960) (*nom. inval.*, Art. 33.2).

[1] Glabrous small herbs or perennial subshrubs; **R** tuberous-thickened; stems branched from the base, dying to the base after flowering, or lower parts persistent and becoming woody and branched, at flowering time with compact sterile **Br** 5 - 10 mm long, flowering **Br** erect or sometimes decumbent and rooting at the nodes, simple or few-branched, smooth or papillose, 5 - 30 cm; **L** linear to oblong, subterete or flattened, acute or rounded, spurred, $4 - 15 (-20) \times 1 - 2 (-4)$ mm, green or becoming reddish, often at first glaucous; **Inf** usually dense, with 2 to several cincinni, each 2 - 7 cm long with $\pm 2 - 10 (-15)$ subsessile **Fl**; **Ped** 0 - 1 (-4) mm; **Sep** $\pm$ appressed to the **Cl**, spurred, unequal, 2 - 6 mm; **Cl** 5 - 8 mm, 6 - 10 mm $\varnothing$; **Pet** white or reddish, tube $\pm$ as long as the lobes, lobes $3 - 5 \times 1.8 - 3.5$ mm, mostly spreading or somewhat reflexed; **Anth** dark; **NSc** almost square or narrow, ± 0.5 mm wide; **Ca** 4 - 7 mm, connate for ± 0.5 mm; **Fr** erect; **Se** ovoid, mamillate, $\pm 0.5 \times 0.25$ mm. – *Cytology*: $n = 23$.

Moran (1998c) provided a broader concept for this species. The oldest name for the taxon is *Umbilicus mexicanus* Schlechtendal, but since this epithet is pre-occupied by *Sedum mexicanum* Britton 1899, the epithet of the next younger synonym *Altamiranoa goldmanii* has to be chosen. – [J. Thiede]

S. gracile C. A. Meyer (Verz. Pfl. Casp. Meer. 151-152, 1831). **T:** Caucasus (*Meyer* s.n. [LE]). – **D:** Turkey, Caucasus (e.g. Azerbaidzhan), N Iran; stony places in the subalpine and alpine zones. **Fig. XXXV.e**

Incl. *Sedum gracile* var. *majus* C. A. Meyer (1831); **incl.** *Sedum gracile* var. *minus* C. A. Meyer (1831); **incl.** *Sedum vuralianum* J. Metzger (1993).

[2?] Glabrous tufted perennial herbs with creeping or ascending short rooting **Br**; **L** alternate, densely imbricate, sessile, spurred, linear-subulate to linear-oblong, 5 - 6 mm, subobtuse, bright green; flowering **Br** usually simple, erect, to 7 (-10) cm tall, densely leafy; **Inf** dense bracteate cymes with 2 - 3 monochasial (rarely forked) **Br**; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, basally connate, elliptic or broadly triangular, 1 - 2 mm, subobtuse; **Pet** lanceolate, ± 4 mm, acuminate, white, sometimes suffused with pink or with reddish keels; **Fil** white; **Anth** red; **NSc** cuneate to oblong, emarginate; **Fr** erect, brown; **Se** oblong-ovoid, pale brown, costate. – *Cytology*: $2n = 12$.

S. grammophyllum Fröderström (Acta Horti Gothob. 10(Appendix): 164-165, ills., 1936). **T:** China, Guangdong (*Ko* 50494 [W]). – **D:** China (C and W Guangdong, E Guangxi).

[1] Perennial herbs with small sterile stems; **L** probably in whorls, linear or oblanceolate, subacute, broadly spurred, mamillate at the tip, 20 - 30 mm; flowering **Br** ascending, weak, to 20 cm; **Inf** lax few-flowered cymes with 2 or 3 cincinni; **Bra** 10 -

15 mm; **Fl** 5-merous, partly enveloped by the **Bra**; **Sep** basally free, shortly spurred, unequal, broadly lanceolate, subacute, 4 - 5 mm; **Pet** free at the base, lanceolate, long mucronate, tapering towards the tip, yellow, ± 6 mm; **NSc** subspatulate-square, slightly emarginate; **Sty** long; **Fr** spreading to sub-stellate; **Se** subovoid, papillate.

Very close to *S. lineare* and perhaps conspecific (Fu & Ohba 2001: 250).

S. grandipetalum Fröderström (Acta Horti Gothob. 10(Appendix): 52, ills., t. 32, 1936). **T**: Mexico, Jalisco (*Mexia* 1625 [NY]). – **D**: Mexico (W Trans-Mexican Volcanic Belt); ± 2500 m. **I**: Clausen (1959: 246).

[1?] Glabrous perennial herbs, epiphytic, densely leafy, with cone-shaped **Ros** at the base of the stems; **L** alternate, lanceolate, elliptic-lanceolate or linear-lanceolate, obtuse, falcate, with 2 spurs at the base and clasping the stems, sometimes slightly papillose marginally, glaucous, green, $7.5 - 21 \times 3.5 - 8$ mm; flowering **Br** prostrate or pendulous, 11 - 41 cm; **Inf** cymes with 2 - 4 recurved **Br**; **Ped** ± 2.5 mm; **Fl** 5- (rarely 4- or 6-) merous; **Sep** sessile, rarely shortly spurred, basally slightly connate, unequal, lanceolate or elliptic-oblong, obtuse, $3.1 - 8.8 \times 1.7 - 3.3$ mm, erect; **Pet** free or slightly connate, elliptic or elliptic-lanceolate, acute or obtuse, minutely mucronate, glaucous dorsally, yellow, ± 7.5 mm, spreading; **Anth** yellow; **NSc** reniform or reniform-obovate, emarginate, white or yellow, translucent; **Sty** rather long; **Fr** divergent, pale brown; **Se** elongately pear-shaped, glabrous, dark brown, costate (based on 1 **Se**). – *Cytology*: $2n = 68$.

S. grandisepalum R. T. Clausen (CSJA 21(5): 149-151, ills., 1949). **T**: Mexico, Oaxaca (*MacDougal* B102 [CU]). – **D**: Mexico (Oaxaca); rocks, 2100 m.

$\equiv$ *Villadia grandisepala* (R. T. Clausen) R. T. Clausen (1959).

[1] Perennial erect shrublets to 15 cm tall; stems glabrous, branched, brown, green above; **L** alternate, sessile, elliptic-oblong, obtuse to subacute, flat and convex, $10.2 - 17 \times 3.4 - 4.4$ mm, to 2.2 mm thick, without a spur; **Inf** dense terminal cymes 2 - 3 cm $\varnothing$ with 3 - 7 **Fl**; floral **Bra** elliptic-oblong, $9 - 13 \times 2.6 - 4$ mm; **Fl** 5-merous, sessile, $9 - 12$ mm $\varnothing$; **Sep** oblong, erect with spreading tips, $7.5 - 10$ mm; **Pet** lanceolate-oblong, erect with spreading tips, greenish-yellow, as long as the **Sep** or shorter; **Ca** erect, basally connate.

Compared to *S. luteoviride* and *S. chloropetalum* in the protologue.

S. grandyi Hamet (BJS 50(Beiblatt 112): 1112, 1913). **T**: Peru, Amazonas (*Matthews* s.n. [G-BOIS]). – **D**: Peru (Amazonas: Chachapoyas).

$\equiv$ *Altamiranoa grandyi* (Hamet) A. Berger (1930)

$\equiv$ *Villadia grandyi* (Hamet) Baehni & Macbride (1937).

[1] Small tufted perennial herbs with suberect stems ± 10 cm tall with small sterile **Br**; **L** alternate, ovate to suborbicular, subobtuse, shortly spurred, $5 - 6.5$ mm; flowering **Br** erect; **Inf** few-flowered corymbs; **Fl** subsessile, 5-merous; **Sep** shortly spurred, unequal, subovate, obtuse, $4.5 - 5 \times \pm 2.5$ mm, the fifth **Sep** oblong, subobtuse, $\pm 4 \times 2$ mm; **Pet** basally connate up to 1.5 mm, broadly subovate, subobtuse, colour not described, mucronate, ± 6 mm; **Sty** long; **NSc** subquadrate-spatulate, emarginate; **Fr** erect.

S. greggii Hemsley (Diagn. Pl. Nov. Mexic. 1: 12, 1878). **T**: Mexico, Hidalgo (*Gregg* 635 [K]). – **D**: Mexico (C Mexican Plateau, Trans-Mexican Volcanic Belt); 1300 - 2745 m. **I**: Fröderström (1936a: 43, t. 27); Clausen (1959: 252).

Incl. *Sedum heterophyllum* Rose in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sedum diversifolium* Rose (1903); **incl.** *Sedum greggii* ssp. *angustifolium* R. T. Clausen (1978).

[1] Perennial herbs with cone-shaped **Ros** at the base of the flowering **Br**; **L** alternate (rarely decussate), obovate, oblanceolate or elliptic, rounded to obtuse, sessile, papillose, $3 - 12 \times 1.2 - 5$ mm, divergent or reflexed; flowering **Br** erect, decumbent or pendulous, 2.7 - 15 cm; **Inf** branched cymes with 1 to many **Fl**; **Ped** 0.5 - 6 mm; **Fl** (4- to) 5-merous; **Sep** basally free, mostly broadly spurred, elliptic-ovate, obtuse, papillose marginally, green, $1.7 - 7.7 \times 0.8 - 3$ mm, erect; **Pet** basally free (rarely connate), elliptic or ovate, acute, mucronate, carinate, sulphur-yellow, sometimes with red-speckled keel, ± 6 mm, spreading; **Anth** yellow; **NSc** subquadrate, obovate or oblong, truncate, yellow; **Sty** rather long; **Fr** divergent, brown; **Se** lanceolate to ellipsoid, brown, reticulate-papillose. – *Cytology*: $2n = 36, 52, 53, 60, 66, 72, 68, \pm 148$.

The ssp. *angustifolium* differs cytologically and in having linear leaves in the inflorescence. – [H. 't Hart, B. Bleij & U. Eggli]

S. griffithsii Rose (North Amer. Fl. 22(1): 71, 1905). **T**: USA, Arizona (*Griffiths* 6061 [NY ?]). – **D**: S USA (Arizona); N Mexico; to 2800 m.

[1] Tufted perennial herbs with elongated thickened **R**, old stem remnants persistent; **L** alternate, basal **L** pseudopetiolate-oblanceolate or spatulate-oblong, obtuse, flattened, mamillate, 6 - 10 mm, middle and upper **L** lanceolate, glabrous and shortly spurred, 5 - 15 mm; flowering **Br** erect, rather stout, simple or few-branched, 5 - 11 cm; **Inf** compact, few-flowered; **Bra** subovate, obtuse, ± 3.5 mm; **Fl** 5-merous, sessile; **Sep** basally free, broadly spurred, unequal, suboblong, obtuse, $3.5 - 4.5$ mm, erect; **Pet** basally slightly connate, oblong, subobtuse, shortly mucronate, 7 - 9 mm, suberect; **NSc** broader than long, flat, emarginate to slightly erose; **Sty** rather

long; **Fr** stellately spreading; **Se** lanceolate, reticulate.

S. grisebachii Boissier & Heldreich (in Boissier, Diagn. Pl. Orient. 2(2): 61, 1856). **T** [lecto]: Greece, Athos (*Grisebach* 503 [GOET]). – **D**: C and S Balkans, Rumania to C Greece, Turkey (reported from the vicinity of Istanbul).

≡ *Sedum sexangulare* ssp. *grisebachii* (Boissier & Heldreich) J. A. Huber (1936).

[1] Annual or perennial herbs, sterile shoots rooting, much-branched, ascending, short, usually forming dense tufts; **L** densely imbricate, linear-oblong to oblanceolate, subacute with 3 - 12 hyaline papillae at the tip, semiterete, with a short truncate basal spur, 5 - 6 mm, bright green; flowering **Br** erect or ascending, usually simple, slender, 2 - 15 cm, sometimes with a few small subsidiary axillary cymes; **Inf** cymes with 2 - 4, rarely forked cincinni; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, unequal, linear or narrowly elliptic, subacute with some papillae at the tips, to 5 mm; **Pet** lanceolate-elliptic, 4 - 6 mm, yellow or pale yellow; **Fil** yellow; **Anth** yellow, rarely red; **NSc** square; **Sty** slender; **Fr** stellately patent, pale brown or brown, with distinct lips along the suture; **Se** pale brown, reticulate-papillose. – *Cytology*: $2n = 16, 32$.

A variable species with respect to habit, size of the inflorescences and ecological preference. The morphological variation constitutes a cline over an altitudinal gradient, ranging from small perennial plants at high altitudes to large, often annual plants at sea-level. Plants retain their original habit to some extent when cultivated under identical conditions. In Greece the two extremes of this morphological series occur, but intermediate types, which cannot be properly assigned to either form or ecotype, abound in adjacent Bulgaria and Macedonia. Accordingly the Greek ecotypes are distinguished as varieties rather than subspecies (Greuter & al. 1986). The extreme types of the morphological series are diploid, but the intermediate forms are either diploid or tetraploid. The species belongs to the comparium of *Ser. Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. grisebachii var. *grisebachii* – **D**: Bulgaria, NE Greece, Turkey (European part); mostly lowlands, open rocky places, on rocks or wooded places, in Greece from sea-level to 1300 (-1600 m).

Incl. *Sedum annuum* var. *racemiferum* Grisebach (1843) ≡ *Sedum racemiferum* (Grisebach) Halácsy (1901); **incl.** *Sedum kostovii* Stefanoff (1950) ≡ *Sedum flexuosum* ssp. *kostovii* (Stefanoff) 't Hart (1978) ≡ *Sedum grisebachii* ssp. *kostovii* (Stefanoff) Greuter & Burdet (1986).

[1] Annuals or perennials, usually forming tufts of ascending branched shoots; flowering **Br** to 15 cm; **Inf** lax cymes with 2 - 4 cincinni and up to

35 **Fl**; **Anth** yellow, rarely red. – *Cytology*: $2n = 16, 32$.

Plants from Thasos differ by the dark red anthers. – [H. 't Hart]

S. grisebachii var. *horakii* (Rohlena) 't Hart (Willdenowia 13(2): 304, 1983). **T**: Montenegro (*Rohlena* s.n. [PRC, BP]). – **D**: Greece (mountain in C and N), Macedonia (Sar Planina), Rumania (Carpatians), Bulgaria.

≡ *Sedum alpestre* var. *horakii* Rohlena (1904) ≡ *Sedum horakii* (Rohlena) Rohlena (1923) ≡ *Sedum annuum* var. *horakii* (Rohlena) Fröderström (1932); **incl.** *Sedum flexuosum* Wettstein (1892) ≡ *Sedum grisebachii* ssp. *flexuosum* (Wettstein) Greuter & Burdet (1986).

[1] Small perennials, forming dense tufts or mats of short densely leafy branched shoots; flowering **Br** usually simple, (1-) 2.5 (-6) cm; **Inf** few-flowered cymes with 1 - 3 cincinni and (3-) 8 (-12) **Fl**. – *Cytology*: $2n = 16$.

This is a dwarfed alpine or montane variant (usually above 1500 m), most prominent in the W part of the range of the species. In Bulgaria (Rila Mts., Pirin Mts. and Rodopi Mts.), the 2 varieties merge and become virtually indistinguishable. – [H. 't Hart]

S. griseum Praeger (J. Bot. 55: 43, 1917). **T**: not indicated. – **D**: Mexico (Michoacán: C Trans-Mexican Volcanic Belt, C Mexican Plateau). **I**: Fröderström (1936a: 27, t. 16); Clausen (1959: 160).

[1] Perennial subshrubs with erect (or procumbent) much-branched stems with flaking bark and papillose twigs; **L** crowded, alternate, linear or lanceolate-linear, obtuse, sessile, (sub-) terete, finely papillose, sometimes sparingly hirtellous dorsally, often subglaucous, green, 5.9 - 28 × 1.7 - 3.2 mm; flowering **Br** erect or ascending; **Inf** cymes with 1 to many **Br**; **Ped** to 3 mm; **Fl** 5-merous (rarely 6-merous or with 2 **Pet** fused and thus 4-merous); **Sep** basally free, shortly spurred, unequal, lanceolate, ovate or lanceolate-oblong, obtuse or acute, pale green, 2.4 - 8.1 × 0.9 - 2.2 mm, erect; **Pet** basally connate, lanceolate, obtuse or acute, mucronate, sometimes slightly hooded, carinate, whitish, ± 7 mm, spreading to slightly recurved; **Fil** white; **Anth** yellow; **NSc** reniform, emarginate, creamy-white or pale yellow; **Fr** erect, brown; **Se** pear-shaped, brown, reticulate. – *Cytology*: $2n = 52, 60$.

S. guadalajaranum S. Watson (Proc. Amer. Acad. Arts 22: 411, 1887). – **D**: Mexico (Jalisco), ± 1700 m. **I**: Fröderström (1936a: 28, t. 17).

Incl. *Sedum guadalajaranum* ssp. *viridifolium* R. T. Clausen (1978).

[1] Glabrous perennial subshrubs with thick **R**-stock with napiform **R** and roughened much branching stems, to 30 cm tall; **L** alternate, linear, subacute, shortly spurred, mamillate, slightly glauc-

ous, 3 - 15 mm, spreading; flowering **Br** erect; **Inf** lax corymbs; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, slightly unequal, linear to lanceolate, subobtuse, 3 - 3.5 mm, erect; **Pet** basally slightly connate, lanceolate, subacute, narrowly mucronate, slightly narrowed at the base, white with red midrib, 5 - 6 mm, suberect; **Anth** dark red; **NSc** subquadrate, slightly emarginate; **Fr** widely spreading, red; **Se** ovoid, reticulate-papillose. – *Cytology*: $2n = 58$.

S. guatemalense Hemsley (Diagn. Pl. Nov. Mexic. 11, 1878). **T**: Guatemala (*Salvin & Godman* 78 [K]). – **D**: Guatemala; ± 2300 m. **I**: Fröderström (1936a: 33, t. 22).

[1] Perennial subshrubs with procumbent slender stems, 20 - 30 cm tall; **L** alternate, spatulate-suboblong, obtuse, base shortly spurred, terete, 5 - 9 mm; flowering **Br** ascending, papillose; **Inf** lax corymbs; **Bra** oblanceolate, obtuse, small; **Ped** papillose; **Fl** 5-merous, long pedicellate; **Sep** broadly sessile, slightly unequal, linear, obtuse, 3 - 5 mm, erect; **Pet** basally nearly free, subovate, subobtuse, rather long and narrowly mucronate, reddish-yellow, 5 - 6 mm, suberect; **NSc** very long, linear, truncate and slightly emarginate, thick; **Sty** short and spreading; **Fr** very broad and turgid, many-seeded; **Se** very long, linear, sub lanceolate, reticulate. – *Cytology*: $2n = 54$.

S. gypsicola Boissier & Reuter (Diagn. Pl. Nov. Hisp. 13, 1842). **T**: Spain, Aranjuez (*Reuter* s.n. [G-BOIS]). – **D**: C and S Spain, Italy (Sicily), N Africa (Morocco, Algeria).

$\equiv$ *Sedum album* var. *gypsicola* (Boissier & Reuter) Hamet (1929) $\equiv$ *Sedum album* ssp. *gypsicola* (Boissier & Reuter) Maire (1932) $\equiv$ *Oreosedum gypsicola* (Boissier & Reuter) Grulich (1984); **incl.** *Sedum gypsicolum* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Sedum album* var. *eu-gypsicola* Maire (1977) (*nom. inval.*, Art. 26.1).

[1] Basally densely glandular-pubescent perennial herbs, laxly caespitose with creeping stems bearing short ascending non-flowering shoots; **L** alternate, patent or appressed, sessile and scarcely spurred, linear-cylindrical to ovoid-globose, 3 - 10 (-20) mm, obtuse, semiterete to terete, often flattened on the upper face, covered with longitudinal rows of papillae, glaucous or green and often reddish; flowering **Br** erect, 5 - 18 (-30) cm; **Inf** rather dense many-flowered subcorymbose cymes, freely branched, bracteate; **Bra** 1 per **Fl**, small; **Ped** to 4 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, ovate to triangular, to 1.5 mm; **Pet** free, lanceolate, 1.5 - 4.5 mm, subacute, white or rarely pink; **Fil** white; **Anth** dark red; **NSc** spatulate; **Sty** slender, to 1 mm; **Fr** erect, whitish; **Se** oblong or ovoid, pale yellowish-brown, costate; – *Cytology*: $2n = 34, 68, 102$.

Almost identical to *S. album*, but easily distin-

guished by the papillate leaves. The 2 species have very different distribution areas but occur in similar habitats. No mixed stands are known to occur.

S. gypsophilum B. L. Turner (Phytologia 59(5): 321-322, 1986). **T**: Mexico, Nuevo León (*B. L. Turner & al.* 15557 [TEX, UMEX]). – **D**: Mexico (Nuevo León); gypsum rocks. **I**: Sedum Soc. Newsletter. No. 61: 60, 2002.

Incl. *Sedum calcicola* ssp. *desertorum* R. T. Clausen (1978).

[1] Glabrous perennial subshrubs with erect slender somewhat flexuous stems, branched from the base, to 30 cm tall; **L** alternate, ovate to ovate-lanceolate, acute, 5 - 12 $\times$ 1 - 3 mm; **Inf** cymes with 2 (-3) **Br**; **Sep** narrowly ovate, acute, 4 - 5 mm; **Pet** narrowly acute, white, $\pm 10 \times 2 - 3$ mm, spreading; **Sty** long.

The measurements for the leaf length given in the protologue appear to be erroneous and are here corrected. The taxon is related to *S. calcicola* and *S. lenophylloides*.

S. hakonense Makino (Bot. Mag. (Tokyo) 15: 35, 1901). **T**: Japan, Honshu (*Anonymus* s.n. [TI]). – **D**: China (N Guangdong), Japan (S Hondo, Honshu); in cool-temperate mountain forests, on rocks or tree trunks, 1600 - 1700 m. **I**: Fröderström (1931: 102, t. 65). **Fig.** XXXV.f

Incl. *Sedum habonense* Makino (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Sedum rupifragum* Koidzumi (1938) $\equiv$ *Sedum hakonense* var. *rupifragum* (Koidzumi) Ohwi (1965).

[1] Perennial herbs with rather stout basally much branched suberect stems, 6 - 8 cm tall; **L** alternate, narrowly oblanceolate, somewhat rounded, fleshy, 5 - 25 mm; flowering **Br** erect to ascending, loosely tufted, decumbent at the base, 6 - 10 cm tall; **Inf** rather lax many-flowered cymes with 3 sometimes forked cincinni; **Bra** L-like, 4 - 10 mm; **Fl** 4- (rarely 5-) merous, sessile; **Sep** broadly sessile, unequal, triangular, obtuse, nodulate near the tip, 1-veined, 0.5 - 1 mm; **Pet** ovate-lanceolate to semi-oblong, acute, shortly mucronate, yellow, 4 - 4.5 mm; **NSc** broadly spatulate, obtuse, shortly unguiculate, with retuse-truncate or obcordate tip; **Sty** short; **Fr** semidivergent, basally connate for ± 2.5 mm; **Se** lanceolate-ovate, reticulate-papillose. – *Cytology*: $2n = 136$ (as *S. rupifragum*).

Sedum rupifragum has 4- or 5-merous flowers. Ohwi (1965: 35) included it in *S. hakonense* as variety, while Ohba (2001: 27-28) recognized it as a separate species.

S. hangzhouense K. T. Fu & G. Y. Rao (Acta Bot. Boreal.-Occid. Sin. 8(2): 119-120, ill., 1988). **T**: China, Zhejiang (*Anonymus* "s. coll. no. 71" [SZ]). – **D**: China (N Zhejiang); forested slopes, shady moist rocks.

[1] Erect or ascending annual herbs branching

from the base, 8 - 20 cm tall; **L** alternate, narrowly obovate or spatulate-oblong, obtuse to rounded, narrowly cuneate at the base, spurred, 20 - 30 × 3 - 7 mm; **Inf** many-flowered cymes; **Bra** L-like, 6 - 20 × 2 - 5 mm; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, almost equal, broadly linear to triangular, obtuse, 1.5 - 2.4 × 0.3 - 0.6 mm; **Pet** basally slightly connate, linear-lanceolate, yellow, 4 - 4.5 mm; **NSc** subspatulate; **Fr** divergent to stellately patent, with lips along the sutures; **Se** reticulate-papillose.

S. heckelii Hamet (Notul. Syst. (Paris) 1: 139-140, 1910). **T**: Tibet (*Soulié* 3981 [P]). – **D**: E Tibet, China (W Sichuan); forests, forest margins, rocks and gravel in valleys, 3500 - 4200 m. **I**: Fröderström (1931: 84, t. 50); Fu & Fu (1984: t. 21).

[1] Perennial herbs with small sterile shoots; **L** alternate, imbricate, lanceolate to oblong, acuminate, broadly spurred; flowering **Br** usually simple, 3 - 8 cm; **Fl** 5-merous; **Sep** basally free, shortly spurred, unequal, acuminate, 4 - 5 mm; **Pet** oblong, shortly acuminate, yellowish, 5 - 6 mm; **NSc** rectangular-spatulate; **Sty** long; **Fr** suberect, basally connate for 1 mm or more, with lips along the sutures.

S. hemsleyanum Rose (Bull. New York Bot. Gard. 3(9): 41, 1903). **T**: Mexico, Oaxaca (*Pringle* 6042 [US 865461, ENCB]). – **D**: Mexico (Sierra Madre del Sur, E Trans-Mexican Volcanic Belt: Hidalgo, Morelos, Puebla, Guerrero, Oaxaca), 1340 - 2000 m. **I**: Fröderström (1936a: 75, t. 47); Clausen (1959: 228).

≡ *Sedastrum hemsleyanum* (Rose) Rose (1905); **incl.** *Sedastrum painteri* Rose (1905) ≡ *Sedum painteri* (Rose) A. Berger (1930); **incl.** *Sedastrum pachucense* C. H. Thompson (1911) ≡ *Sedum pachucense* (C. H. Thompson) Praeger (1921).

[1] Perennial herbs with dense **Ros** near the base of the flowering **Br**; **L** alternate, oblanceolate-oblong, obovate, lanceolate or linear-lanceolate, acute to obtuse, pubescent, green, 13 - 59 × 4 - 13 mm; flowering **Br** erect, 3 - 38 cm; **Inf** paniculate; **Fl** 5-merous, sessile, with pungent scent; **Sep** broadly sessile, basally connate, equal, ovate or elliptic, acute or obtuse, pubescent, green, 2.3 - 8 × 1.4 - 3.9 mm; **Pet** basally connate, ovate or lanceolate, acute or obtuse, mucronate, carinate, white, with partly green keel, ± 5.5 mm; **Anth** red, sometimes yellow, papillose; **NSc** subquadrate or lanceolate-oblong, pale yellow, sometimes white; **Fr** erect, with narrow lips along the ventral suture; **Se** pear-shaped, glabrous, brown, reticulate. – *Cytology*: 2n = 40, 79, 78 - 80, 80, 81, 82, 83, 120, 170 ± 3, ± 180, ± 194, 228 ± 2, 240 ± 2.

S. hengduanense K. T. Fu (Acta Bot. Boreal-Occid. Sin. 6(2): 105-107, ill., 1986). **T**: China, Sichuan (*Quing-zang Exped.* 3373 (1981) [PE]). – **D**:

SE Tibet, China (SW Sichuan, NW Yunnan); river banks, arid slopes, on rocks, 2100 - 2900 m.

[1] Perennial herbs with sterile stems to 1.5 cm; **L** alternate, linear-lanceolate, oblanceolate, obovate, subspatulate to narrowly elliptic, obtuse to acute, slightly spurred, flat, 5 - 9 × 1 - 2 mm; flowering **Br** slender, simple or much branched, 3 - 6 cm; **Inf** many-flowered cymes with 2 or 3 cincinni; **Ped** to 1.5 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, distinctly unequal, semi-oblong to oblanceolate, obtuse to acute, to 5 × ± 1 mm; **Pet** basally slightly connate, oblong-lanceolate, acuminate, yellow, 3.5 - 4 mm; **Anth** yellow; **NSc** broadly cuneate, rounded; **Sty** ± 1 mm; **Fr** stellately patent, with lips along the sutures; **Se** subovate, smooth.

S. henrici-robertii Hamet (RSN 12: 407-409, 1913). **T**: Tibet (*Dungboo* 4591 [CAL]). – **D**: S Tibet, Nepal?, Bhutan?, Sikkim?, China (E Qinghai); rocks, stony places, 3800 - 5000 m. **Fig. XXXV.g**

[1] Annual or biennial herbs with ascending stems, branched at the base, 1 - 3 cm tall; **L** alternate, broadly linear to subovate, acute, 2.5 - 5 mm; **Inf** few-flowered corymbs; **Fl** 5-merous; **Sep** basally free, shortly spurred, lanceolate to subovate, acute, ± 3 mm; **Pet** basally slightly connate, suboblong, subacute, submucronate, white, ± 3 mm; **NSc** narrowly linear, obtuse; **Sty** very short; **Fr** erect, few-seeded; **Se** reticulate-papillose.

S. hernandezii J. Meyrán (Cact. Suc. Mex. 35(2): 27-29, 48, ill., 1990). **T**: Mexico, Puebla (*Otero* 199 [MEXU, ENCB, IZTA]). – **D**: Mexico (Puebla); E hill slopes with oak forest, ± 2500 m. **Fig. XXXV.h**

[1] Perennial herbs with numerous ascending to pendent branched stems, ± 14 cm tall, covered with simple **Ha**; **L** in whorls of 5, obovate to elliptic, rounded to obtuse, terete, sometimes subterete, furfuraceous, 12 - 14 × 10 - 13 mm, 10 - 11 mm thick; flowering **Br** erect; **Inf** few-flowered cymes with dichasial **Br**; **Ped** ± 3 mm, papillose; **Fl** 5-merous; **Sep** broadly sessile, lanceolate to triangular, subterete, papillose, light green, ± 3 × 1 mm; **Pet** basally slightly connate, lanceolate, canaliculate, yellow, ± 5 mm; **Fil** yellow; **Anth** creamy-white to yellow; **NSc** subquadrate, yellow or amber-coloured; **Sty** ± 2 mm.

Obviously related with *S. furfuraceum*.

S. hintonii R. T. Clausen (Bull. Torrey Bot. Club 70: 292-294, ill., 1943). **T**: Mexico, Michoacán (*Hinton & al.* 15926 [US 1808082]). – **D**: Mexico (Michoacán: Sierra Madre del Sur). **Fig. XXXVI.b**

[1] Perennial herbs with prostrate stout **Rstock**, with several dense **Ros**; axes and **L** covered with white, hyaline, mottled, somewhat flattened and stiff **Ha** to 1.5 mm; **L** crowded, alternate, narrowly oblong or elliptic, obtuse, 15 - 50 × 3 - 10 mm, yel-

lowish-brown when dried; flowering **Br** to 24 cm; **Inf** paniculate cymes; **Fl** 5-merous, sessile, with musky scent; **Sep** elliptic-ovate, obtuse, 2 - 2.5 × ± 1.2 mm; **Pet** oblong-lanceolate, white, with crisped margins, 4 - 5 mm, spreading; **NSc** oblong, almost square, 0.3 mm; **Fr** with lips along the ventral suture; **Se** somewhat pear-shaped, red. – *Cytology*: 2n = 50.

A closely related species was recently described as *S. mocinianum*. W. A. Fitz-Maurice (pers. comm.) indicates that the taxon extends to W Zacatecas and Jalisco. – [H. 't Hart, B. Bleij & U. Eggli]

S. hintoniorum B. L. Turner (Phytologia 78(6): 405-407, 1995). **T**: Mexico, Nuevo León (*Hinton & al.* 23797 [TEX, GH, MEXU]). – **D**: Mexico (Nuevo León, Tamaulipas); boulders in pine-oak woodlands, 1800 - 2100 m. **I**: *Sedum* Soc. Newslett. No. 43: t. 10H, 1998.

[1] Perennial suffruticose herbs 15 - 20 cm tall; **R** forming fusiform tubers 1 - 2 × 0.2 - 0.5 cm; stems glabrous, upper stems and **Br** of the **Inf** becoming winged when dry, uppermost parts appearing subpapillose; **L** alternate, oblanceolate, to 2 × 0.4 cm, green, glabrous and smooth; **Inf** terminal rather lax paniculate cymes 3 - 5 cm Ø, or leafy secund flowering **Br**; **Fl** 5-merous; **Sep** unequal, free, 2 - 4 mm, ± lanceolate; **Pet** rarely only 4, 4 - 6 × 1 - 2 mm, broadly lanceolate, reflexed at anthesis, white with a green or rosy mid-rib towards the acute tip; **NSc** very small, reniform, white; **Ca** 4 - 5 mm, erect to somewhat spreading; **Se** ± 0.7 mm, brown, minutely papillose.

Compared to *S. caducum* in the protologue, which differs in stiffly erect and papillose stems, leaves speckled with red, and the cucullate petal tips. – [U. Eggli]

S. hirsutum Allioni (Fl. Pedem. 2: 122-123, 3: t. 65:5, 1785). **T**: Italy (*Anonymus* s.n. [TO ?]). – **D**: SW Europe (Spain, Portugal, France, Italy), N Africa (Morocco).

≡ *Leucosedum hirsutum* (Allioni) Fourreau (1868) (*nom. inval.*, Art. 43.1) ≡ *Oreosedum hirsutum* (Allioni) Grulich (1984) ≡ *Rosularia hirsuta* (Allioni) Eggli (1988); **incl.** *Sedum hirsutum* var. *rubellum* Merino (s.a.); **incl.** *Sedum hirsutum* var. *maroccanum* Font Quer (1928); **incl.** *Sedum winkleri* var. *maroccanum* Font Quer (1928); **incl.** *Sedum hirsutum* var. *gattefossei* Maire & al. ex Maire (1938); **incl.** *Sedum hirsutum* var. *thermarum* Maire & al. ex Maire (1938).

[1] Densely glandular-pubescent rosulate perennial herbs, usually forming tufts and propagating through axillary propagules consisting of a simple L-less stolon to 6 cm long with a terminal rooting **Ros**; **L** alternate, oblanceolate, obtuse, sessile, semiterete; flowering **Br** simple, erect, sparsely leafy, 5 - 12 (-15) cm; **Inf** cymes with (1-) 2 (-3) cincinni; **Bra** 1 per **Fl**, small, oblong; **Ped** 3 - 6 mm; **Fl** 5-

merous; **Sep** broadly sessile, slightly connate basally, oblong, acute, to 2.5 mm; **Pet** basally connate, spreading, white; **Fil** white; **Anth** dark red; **NSc** oblong, yellowish; **Fr** erect, brown or greyish-brown; **Se** oblong-ovoid, pale brown, costate.

In addition to ssp. *baeticum* and ssp. *wilczekianum* (the latter here treated at species rank), Maire (1977: 330-332) distinguished several poorly defined varieties within Morocco.

S. hirsutum ssp. *baeticum* Rouy (Bull. Soc. Bot. France 34: 441, 1887). **T**: Spain (*Reverchon* 271 [LY]). – **D**: S Spain, Gibraltar, also reported from Morocco.

≡ *Sedum hirsutum* var. *baeticum* (Rouy) Praeger (1918) ≡ *Oreosedum hirsutum* ssp. *baeticum* (Rouy) Velayos (1989); **incl.** *Umbilicus winkleri* Willkomm (1883) ≡ *Cotyledon winkleri* (Willkomm) Pérez Lara (1891) ≡ *Sedum winkleri* (Willkomm) Wollley-Dod (1914) ≡ *Sedum hirsutum* ssp. *winkleri* (Willkomm) Font Quer (1928) ≡ *Oreosedum winkleri* (Willkomm) Grulich (1984); **incl.** *Sedum hirsutum* var. *winkleri* Maire (1932) (*nom. inval.*, Art. 33.2).

[1] Differs from ssp. *hirsutum*: Plants larger and more robust with stout stolons and **Ros** to 4 cm Ø; **L** to 12 (-15) mm, sticky; **Inf** usually compact and many-flowered; **Fl** large; **Pet** basally connate for 3 mm, broadly ovate, rounded with a short mucro, to 5 - 8 mm. – *Cytology*: 2n = 60.

S. hirsutum ssp. *hirsutum* – **D**: Spain, Portugal, Morocco. **Fig. XXXIV.g**

incl. *Sedum hirsutum* var. *jahandiezii* Maire (1932); **incl.** *Sedum hirsutum* ssp. *eu-hirsutum* Maire (1932) (*nom. inval.*, Art. 26.1).

[1] Plants usually small with thin stolons and **Ros** 1 - 2 (-4) cm Ø; **L** 3 - 8 mm, not very sticky; **Inf** often lax and few-flowered; **Pet** basally slightly connate (< 1 mm), lanceolate, acute or acuminate, 3 - 6 mm. – *Cytology*: 2n = 18, 20.

S. hispanicum Linné (Cent. Pl. I, 12, 1755). **T**: [lecto - icono]: Dillenius, Hort. Eltham. t. 256: fig. 332, 1732. – **Lit**: Jalas & al. (1999: 103). **D**: S and C Europe, Balkan Peninsula, Turkey, N Iran, Caucasus Region, Lebanon, Palaestina, naturalized in Japan. **I**: Lippert (1995: 128). **Fig. XXXVI.c**

incl. *Sedum andersonii* G. Don (s.a.); **incl.** *Sedum hispanicum* var. *hispanicum*; **incl.** *Sedum hispanicum* var. *polypetalum* Boissier (s.a.); **incl.** *Sedum semiglabrum* Boissier & Huet in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sedum glaucum* Waldstein & Kitaibel (1805) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum sexfidum* M. Bieberstein (1808); **incl.** *Sedum aristatum* Tenore (1811); **incl.** *Sedum hungaricum* Poirlet (1816); **incl.** *Sedum puberulum* De Candolle (1828); **incl.** *Sedum guettardii* Gmelin ex Koch (1837) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum hispanicum* var. *buxbaumii* Grisebach (1843) ≡ *Sedum*

glaucum var. *buxbaumii* (Grisebach) Hayek (s.a.); **incl.** *Sedum orientale* Boissier (1849); **incl.** *Sedum armenum* Boissier (1856); **incl.** *Sedum glaucum* var. *leiocarpum* Boissier (1872) (*incorrect name*, Art. 11.4); **incl.** *Sedum glanduloso-pubescent* Feichtinger (1873); **incl.** *Sedum pseudohispanicum* Strobl (1884); **incl.** *Sedum hispanicum* var. *eriocarpum* Sommier & Levier (1900); **incl.** *Sedum hispanicum* var. *leiocarpum* Sommier & Levier (1900); **incl.** *Sedum boissieri* Davidov (1915); **incl.** *Sedum hispanicum* var. *minus* Praeger (1921); **incl.** *Sedum hispanicum* var. *semiglabrum* Fröderström (1932); **incl.** *Sedum longibracteatum* Fröderström (1960); **incl.** *Sedum hispanicum* var. *planifolium* Chamberlain (1972); **incl.** *Sedum antiquum* Omelczuk & Zaverucha (1978).

[1] Simple or much-branched annual or perennial herbs, erect or ascending; sterile **Br** sometimes present; flowering **Br** 5 - 15 cm tall; **L** alternate, linear to oblong, semiterete or $\pm$ flat, 4 - 20 mm, glabrous or more rarely glandular-hairy, green or glaucous-green; **Inf** lax to $\pm$ dense cymes, **Br** 2 - 4 with 1 - 8 **Fl** each, **Inf** axes glabrous or commonly glandular-pubescent towards the tip; **Fl** 5- to 9-merous, subsessile; **Sep** $\pm$ 2 mm, acute, glandular-pubescent; **Pet** white with pink mid-vein, 4 - 5 (-7) mm; **Ca** glandular-pubescent or glabrous, white or pale pink, stellate-spreading. – *Cytology*: $2n = 40$.

The variation presented by this common and wide-spread species is substantial, and the patterns of distribution are incompletely understood. Several of the taxa referred to the synonymy of *S. hispanicum* by Chamberlain & Muirhead (1972) might be better placed with *S. eriocarpum*, which in contrast to Chamberlain & Muirhead (l.c.) is accepted in this treatment. Material from the Caucasus and adjacent Turkmenia and Iran has been described as *S. pentapetalum* (see there). – [U. Eggli]

S. holei Hamet (J. Bot. 51: 55-56, 1913). **T**: India, Kumaon (*Rámtch* 7973 [DD]). – **D**: India (Kumaon); $\pm$ 4000 m.

[1] Probably annual herbs with ascending stems, branched at the base, 11 - 18.5 cm; **L** alternate, linear, obtuse, 4 - 17 mm; **Inf** few-flowered; **Fl** 5-merous; **Sep** basally free, shortly spurred, linear-oblong, obtuse, 4 - 5 mm; **Pet** lanceolate to oblong, submucronate, white, 4.5 - 6 mm; **NSc** linear-subspatulate, emarginate; **Sty** short; **Fr** erect, basally connate for $\pm$ 1.5 mm; **Se** reticulate-papillose.

S. holopetalum Fröderström (Österr. Bot. Zeitschr. 40: 119, ills., 1941). **T**: China, Sichuan (*Chu* 3967 [HY]). – **D**: China (W Sichuan); rocks, $\pm$ 2000 m.

[1] Probably perennial herbs, stems erect, slender, $\pm$ 1.5 cm; **L** alternate, densely imbricate, lanceolate or lanceolate-linear, long acuminate, basally obtusely trilobate, to 6 mm; flowering **Br** simple or branched at the base, to 5 cm; **Inf** few-flowered, densely subcorymbose; **Bra** **L**-like; **Ped** 2 - 3 mm;

Fl 5-merous; **Sep** basally free, shortly spurred, suboblong, long acuminate, $\pm$ 4 mm; **Pet** basally slightly connate, oblong-lanceolate, acute, mucronate, yellow, 5 - 6 mm; **Anth** brown; **NSc** rectangular, longer than broad, emarginate, pale yellow; **Sty** to 1 mm; **Fr** suberect, 1- or 2-seeded; **Se** subovoid.

See note for *S. nothodugueyi*.

S. hultenii Fröderström (Acta Horti Gothob. 10 (Appendix): 18, ills., t. 11, 1936). **T**: Mexico, Puebla (*Fröderström & Hultén* 1136 [S]). – **D**: Mexico (Puebla); shady slopes, $\pm$ 1300 m.

[1] Glabrous perennial herbs with many slender sterile stems, suberect, densely leafy; **L** alternate, obovate to orbicular, rounded, shortly petiolate, shortly spurred, 6 - 35 mm; flowering **Br** procumbent or pendent; **Inf** lax few-flowered corymbs; **Bra** oblanceolate, obtuse, $\pm$ 3 mm; **Ped** 2 - 6 mm; **Fl** 5- to 6-merous; **Sep** broadly sessile, basally connate, slightly unequal, linear-lanceolate, obtuse, 2.5 - 3.5 mm, suberect; **Pet** nearly free to the base, subovate, obtuse, shortly mucronate, pale yellow, $\pm$ 5 mm, suberect; **NSc** subquadrate, pale; **Sty** rather long; **Fr** suberect. – *Cytology*: $2n = 52$.

S. humifusum Rose (CUSNH 13(9): 298, pl. 55, 1911). **T**: Mexico, Querétaro (*Pringle* s.n. [US 399703]). – **D**: Mexico (Querétaro). **I**: Fröderström (1936a: 67).

[1] Minute perennial herbs with short stoloniferous **R**stock and many small **Br** forming a dense moss-like carpet; **L** densely imbricate, obovate to nearly orbicular, obtuse, strongly ciliate at the margins, flattened but fleshy, 3 - 4 $\times$ 4 mm; flowering **Br** erect, slender; **Fl** solitary, 5-merous, sessile; **Sep** basally free, shortly spurred, slightly unequal, **L**-like, strongly ciliate at the margins, very thick, 2 - 3 mm; **Pet** nearly free to the base, subovate, subobtusely, bright yellow, 6 - 10 mm, widely spreading; **NSc** minute, spatulate-subquadrate, slightly emarginate, orange-yellow; **Sty** rather long. – *Cytology*: $2n = 68, 70, 136$.

S. ince 't Hart & Alpınar (Edinburgh J. Bot. 56(2): 182, 1999). **T**: Turkey, Konya (*Alpınar & 't Hart* AH24 [ISTE 72678, U]). – **D**: Turkey (S Anatolia); limestone.

[2] Erect usually simple slender annual herbs to 7 (rarely 10) cm tall, glandular-pubescent, esp. in the upper parts; **L** alternate, sessile, with a very short truncate spur, lamina oblong to linear, to 10 mm, rounded, terete, greyish-green or glaucous; **Inf** cymes with (4-) 11 - 13 (-18) **Fl** on 2 or 3 suberect cincinni; **Bra** 1 per **Fl**, **L**-like; **Ped** slender, 1 - 1.5 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, triangular, 0.6 - 0.8 mm, acute; **Pet** free, ovate-oblong to elliptic, 3.5 - 5 mm, acuminate, white, sometimes tinged with red; **Fil** white, glabrous; **Anth** red; **NSc** cuneate to square-oblong, denticulate, yellow; **Sty** $\pm$ 0.8 mm; **Fr** suberect or diver-

gent, smooth, pale brown; **Se** ovoid, pale brown, costate. – *Cytology*: $2n = 14$.

Distinct from *Ser. Aithales* as well as *Ser. Glauco-rubens*. Molecular systematic analyses indicate a sistergroup-relationship with *Prometheum* (cf. protologue).

S. inconspicuum Handel-Mazzetti (Ann. K. K. Naturhist. Hofmus. 27: 66, t. 3: fig. 5, 1913). **T**: Turkey (Handel-Mazzetti 1913 [W]). – **D**: Turkey.

≡ *Sedum kotschyianum* var. *inconspicuum* (Handel-Mazzetti) Fröderström (1932) ≡ *Oreosedum inconspicuum* (Handel-Mazzetti) Grulich (1984).

[2] Sparsely glandular-pubescent minute annual herbs with simple erect stems to 4 cm tall; **L** alternate or partly opposite, obovate to oblong, obtuse, 2 - 3.5 mm; **Inf** 1- or 2-flowered; **Ped** ± 5 mm; **Fl** 4- or 5-merous, with 4 to 10 **St**; **Sep** broadly sessile, equal, triangular, acute; **Pet** ovate, acute, white; **Se** only known as immature **Se** though probably costate.

Only known from the type collection, which consists of only 4 specimens (partly incomplete). The "drooping pedicels" (Fröderström 1932) are an artifact. Most probably the specimens merely represent depauperate individuals of one of the other Turkish white-flowered annual species of Subgen. *Gormanina*. A strong reduction of the number of flowers and number of floral parts is frequently observed in annual *Sedum* species growing under suboptimal conditions.

S. jaccardianum Maire & Wilczek (Bull. Soc. Hist. Nat. Afr. Nord 16: 31-32, 1925). **T**: Morocco, Atlas Moyenne (Maire & al. s.n. [MPU, G, LAU, Z, RAB ?]). – **D**: Morocco (Middle and High Atlas); limestone rocks, 1600 - 2800 m. **I**: Fröderström (1932: 109, pl. 41: 1). **Fig.** XXXIV.h

≡ *Monanthea jaccardiana* (Maire & Wilczek) A. Berger (1930) (*nom. inval.*, Art. 34.1b) ≡ *Rosularia jaccardiana* (Maire & Wilczek) H. Ohba (1978).

[2] Glandular-pubescent rosulate perennial herbs with a short thick monopodial stem (or caudex) and numerous short prostrate axillary stolons with small rooting terminal **Ros**; **L** alternate, obovate-spatulate, or semipetiolate with a petiole 2× the length of the lamina, acute to obtuse, sometimes pubescent, often sticky and with a strong flowery scent, 10 - 20 mm; flowering **Br** axillary, ascending, glandular-pubescent; **Inf** lax few-flowered cymes with 2 (rarely 3) cincinni; **Bra** 1 per **Fl**, small; **Ped** filiform, 10 - 15 mm; **Fl** (5- to) 6- (to 10-) merous, almost globular in bud; **Sep** broadly sessile, basally slightly connate, lanceolate-oblong, acute, glandular-pubescent, to 4 mm; **Pet** basally connate to 0.7 mm, oblong, acuminate, yellow with orange-yellow base, ± 7 mm; **Fil** yellow; **Anth** yellow; **NSc** broadly spatulate-square; **Sty** ± 1 mm; **Fr** erect, brown; **Se** pale brown, costate. – *Cytology*: $2n = 16$.

Closely related to *S. surculosum* and *S. modes-*

tum, both of which are also endemic to the Moroccan High Atlas. All 3 taxa have been classified in *Ser. Monanthoidea*, which is the sistergroup of the Macaronesian *Sempervivoideae*, i.e. *Aeonium*, *Aichryson* and *Monanthes*, see Mes & 't Hart (1994) and Mes (1995a).

S. jahandiezii Battandier (Bull. Soc. Hist. Nat. Afr. Nord 12: 188, 1921). – **D**: W Morocco.

Incl. *Sedum caespitosum* var. *paniculatum* Battandier (1921); **incl.** *Sedum jahandiezii* ssp. *persicinum* Maire & Samuelsson (1939) ≡ *Sedum jahandiezii* var. *persicinum* (Maire & Samuelsson) Maire (1977); **incl.** *Sedum jahandiezii* ssp. *battandieri* Emberger & Maire (1941) (*nom. inval.*, Art. 26.1) ≡ *Sedum jahandiezii* var. *battandieri* (Emberger & Maire) Maire (1977) (*nom. inval.*, Art. 26.1).

[1] Annual herbs with erect or ascending, simple or branched stems to 5 (-10) cm tall; **L** alternate, ovate to oblong, sessile and spurred, obtuse or rounded, terete, to 3 mm; **Inf** few-flowered cymes with (1-) 2 (-3) cincinni; **Bra** 2 per **Fl**; **Fl** 5-merous, subsessile; **Sep** unequal, ovate-oblong, obtuse, to 3 mm; **Pet** free, lanceolate, acuminate, white or pinkish, ± 4 mm; **Fil** white; **Anth** red; **NSc** ovate-stipitate or spatulate, red; **Fr** (sub-) erect, brown; **Se** ovate, reticulate-papillose.

Most probably synonymous with *S. arenarium* from C and S Spain and Portugal. Its affinities are with the comparium of *Ser. Anglica* 't Hart ('t Hart 1991). – [H. 't Hart]

S. jaliscanum S. Watson (Proc. Amer. Acad. Arts 25: 148, 1890). **T** [syn]: Mexico, Jalisco (*Pringle* 2451 [GH, KFTA]). – **D**: Mexico (C and W Trans-Mexican Volcanic Belt); 1570 - 2300 m. **I**: Fröderström (1936a: 131, t. 89).

Incl. *Sedum naviculare* Rose (1903); **incl.** *Sedum syncarpum* Fröderström (1936); **incl.** *Sedum jaliscanum* ssp. *angustifolium* R. T. Clausen (1981).

[1] Perennial herbs with few-leaved **Ros** and small corms producing red tuberculate flowering **Br** in the second year; **L** alternate, ovate, orbicular or reniform, petiolate, 9 - 38 × 3 - 9 mm; flowering **Br** erect, 5 - 15 cm, **L** elliptic-oblong, spatulate or elliptic-oblong, obtuse, spurred, concave ventrally, sometimes papillose, 5 - 30 × 1 - 6 mm; **Inf** terminal cymes with 1 - 7 **Br**; **Fl** 5- (rarely 4- or 6-) merous, sessile or subsessile; **Sep** basally free, shortly spurred, unequal, linear-lanceolate, elliptic-oblong or oblanceolate, obtuse, green, 1.8 - 13.1 × 0.6 - 2.5 mm, erect; **Pet** basally connate, lanceolate or elliptic-lanceolate, acute or obtuse, mucronate, white, ± 4.5 mm, spreading; **Anth** dark red; **NSc** oblong or spatulate-oblong, rounded or emarginate, dark red, sometimes yellow at the base; **Ca** subdivergent, slender; **Fr** erect or subdivergent, pale brown to whitish; **Se** pear-shaped, finely verrucose, brown, reticulate. – *Cytology*: $2n = 22, 32, 34, 36, 40, 42, 46, 48, 50, 68$.

A closely similar plant was recently described as *S. meyranianum*. – [H. 't Hart, B. Bleij & U. Eggli]

S. jiaodongense Y. M. Zhang & X. D. Chen (Bull. Bot. Res., Harbin 10(1): 43-44, ill., 1990). **T:** China, Shandong (*Zhang* 885131 [Herb. Forest. School Shandong Prov.]). – **D:** China (E Shandong).

[1] Perennial herbs with creeping to ascending slender white-membranous winged stems, 4 - 10 cm; **L** alternate, rarely opposite, oblong, obtuse, shortly spurred, fleshy, 3 - 4 mm; **Inf** few-flowered cymes with sometimes forked cincinni; **Fl** 5-merous, subsessile; **Sep** basally free, shortly spurred, long elliptic, obtuse, with a narrow white margin, 1.5 - 2 mm; **Pet** oblong-lanceolate, yellow, 2.5 - 3 mm; **NSc** oblong, truncate; **Fr** stellately patent, with lips along the sutures; **Se** ellipsoid, yellow, reticulate-papillose.

Probably synonymous with *S. uniflorum* ssp. *japonicum* (Fu & Ohba 2001: 345, sub *S. japonicum*).

S. jinianum X. H. Guo (Acta Bot. Yunnan. 18(3): 297-298, ill., 1996). **T:** China, Anhui (*Guo* 94054 [ANUB, KUN]). – **D:** SE China (Anhui); lowlands.

[1] Biennial herbs 10 - 35 cm tall; stems erect, glabrous; **L** alternate; basal **L** elliptic-spatulate, < 10 mm; upper **L** linear-spatulate to linear-oblong, 15 - 30 × 3 - 6 mm, obtuse, basally spurred, **Ax** with several bulbils; **Inf** terminal cymes with 3 primary **Br**; **Bra** L-like; **Fl** almost sessile, 5-merous; **Sep** green, unequal, spatulate-oblong, 1 - 5 mm; **Pet** narrowly lanceolate, ± 5 × 1 mm, yellow, acute; **NSc** inversely trapezoid-oblong, retuse; **Ca** basally slightly united, ± 3 mm; **Sty** ± 1 mm; **Fr** slightly divergent.

Doubtfully distinct from *S. bulbiferum*. – [U. Eggli]

S. jiuhuashanense P. S. Hsu & H. J. Wang (Rheedea 1(1-2): 46, 1991). **T:** China, Anhui (*Wang & Fu* 86112 [FUS?]). – **D:** China (Anhui).

[1] Perennial herbs with decumbent stems, 5 - 15 cm; **L** in whorls of 3, narrowly oblong to linear-oblong, obtuse, shortly spurred, 8.5 - 13.5 × 1.8 - 3.1 mm; flowering **Br** erect to ascending, simple, slender; **Inf** lax 5- to 7-flowered cymes with 2 or 3 cincinni; **Bra** linear-lanceolate, obtuse, 3 - 4 mm; **Fl** 5-merous, subsessile, 9 - 10 mm Ø; **Sep** probably basally free and spurred; **Pet** basally slightly connate, narrowly lanceolate, acuminate, moderately long-mucronate, yellow, 5.5 - 7.2 × 1.3 - 2 mm; **NSc** square-cuneate, slightly emarginate; **Sty** slender; **Fr** divergent.

S. jiuhuashanense is very close to *S. sarmentosum* and *S. angustifolium*. The description of the sepals in the protologue is erroneous and is in fact of the petals.

S. jilungshanense Y. C. Ho (Bull. Bot. Res., Harbin 9(4): 31-34, ill., 1989). **T:** China, Zhejiang

(*Liu* 3278 [Univ. Hangzhou]). – **D:** China (W Zhejiang); moist forested slopes, 800 - 900 m.

[1] Perennial herbs with repent slender stems; **L** in whorls of 3 or sometimes opposite, obovate to oblanceolate or linear-oblong, obtusely rounded to emarginate, cuneate at the base, shortly spurred, (4-) 8 - 10 × 1.5 - 3 mm; flowering **Br** slender, 8 - 10 cm; **Inf** few-flowered cymes, often branched; **Bra** linear; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, linear-obovate, obtuse, 2 - 3 mm; **Pet** free at the base, ovate-lanceolate, pale yellow, 5 - 6 mm; **NSc** square; **Sty** ± 2 mm; **Fr** divergent; **Se** oblong-lanceolate, pale chestnut-brown, reticulate-papillose.

S. jujuyense Zardini (Bol. Soc. Argent. Bot. 14(1-2): 99-103, ill., 1971). **T:** Argentina, Jujuy (*Cabrera & Kiesling* 20222 [LP]). – **D:** N Argentina (Jujuy).

[1] Perennial herbs with fibrous **R** and slender glabrous pending stems; **L** alternate, elliptic, obtuse, (sub-) terete, glabrous, 8 - 12 × ± 2 mm, thick, very shortly spurred; flowering **Br** 15 - 22 cm; **Inf** cymes with di- or monochasial **Br**; **Fl** 5-merous, sessile to shortly pedicellate; **Sep** basally free, shortly spurred, unequal in length, ovoid, obtuse, connate basally with the corolla, hooded, 3 - 5 × ± 1 mm, thick; **Pet** basally connate for up to 2 mm, lanceolate, white, carinate, submucronate, ± 5.5 × 1.5 mm; **NSc** oblong to subspatulate, rounded, flat; **Sty** 2 mm; **Se** ovoid, reticulate.

Probably more properly placed in *Villadia*. – [H. 't Hart & U. Eggli]

S. jurgensenii (Hemsley) Moran (Haseltonia 4: 46, 1996). **T:** Mexico (*Jurgensen* 616 p.p. [K]). – **Lit:** Moran (1998b: with ill.). **D:** C Mexico.

≡ *Cotyledon jurgensenii* Hemsley (1878) ≡ *Altamiranoa jurgensenii* (Hemsley) Rose (1905) ≡ *Altamiranoa elongata* var. *jurgensenii* (Hemsley) Fröderström (1936) (*incorrect name*, Art. 11.4) ≡ *Villadia jurgensenii* (Hemsley) H. Jacobsen (1958).

S. jurgensenii ssp. *attenuatum* Moran (Haseltonia 5: 76, ill. (p. 75), 1998). **T:** Mexico, Puebla (*Moran & Kimnach* 7776 [SD, BH]). – **D:** Mexico (Veracruz, Puebla, Oaxaca); 1800 - 2500 m.

[1] Differs from ssp. *jurgensenii*: **L** strongly ascending, imbricate, narrowly triangular-ovate or upper **L** triangular-lanceolate, subterete, sharply acute or subacuminate; **Sep** slenderly acute or subacuminate; **Pet** narrowly acute. – *Cytology*: n = 23.

Best distinguished from ssp. *jurgensenii* on account of the strongly ascending and imbricate leaves. – [J. Thiede]

S. jurgensenii ssp. *jurgensenii* – **D:** Mexico (Hidalgo, Querétaro, Tamaulipas?, San Luis Potosí, Guanajuato, Puebla, Veracruz); cliffs and rocky

slopes, 1100 - 2900 m, flowers September to December.

Incl. *Altamiranoa elongata* Rose (1903) $\equiv$ *Cotyledon elongata* (Rose) Fedde (1904) (*nom. illeg.*, Art. 53.1) $\equiv$ *Villadia elongata* (Rose) R. T. Clausen (1940); **incl.** *Sedum brandtianum* von Poellnitz (1933); **incl.** *Altamiranoa necaxana* Fröderström (1936) $\equiv$ *Villadia necaxana* (Fröderström) H. Jacobsen (1958).

[1] Weak hispidulous perennial small subshrubs; **R** not thickened or tuberous; stems branching near the base and above, perennial base woody, lower $\frac{1}{3}$ at flowering time with bristly new shoots 0.5 - 3 cm long, with $\pm$ 25 - 50 imbricate **L**, flowering **Br** erect to trailing and rooting, 10 - 50 (-70) cm, glabrous to sparsely or closely puberulent with non-glandular **Ha**; **L** in 3:5 spirals, mostly spreading, triangular-ovate to triangular-lanceolate, acute, 4 - 8 (-15) $\times$ 2 - 3 mm, variously hispidulous, lower **L** densely hispidulous; **Inf** with 2 - 5 cincinni and more, each 1 - 3 (-8) cm long with 2 - 12 (-20) **Fl**; **Sep** erect, $\pm$ appressed to the **Cl**, 2.5 - 5 mm; **Cl** in bud 4 - 6 mm, campanulate to rotate at anthesis, 5 - 8 mm $\varnothing$; **Pet** elliptic, broadly acute, white, lobes 3 - 4.5 $\times$ 1.6 - 2 mm, tube 1 - 1.5 mm; **Anth** red; **NSc** truncate, 0.35 - 0.5 $\times$ 0.6 - 1 mm, deep yellow; **Ca** 3.5 - 4.5 mm, greenish-white. - *Cytology*: $n = 23$. - [J. Thiede]

S. kiangnanense D. Q. Wang & Z. F. Wu (Bull. Bot. Res., Harbin 10(3): 45-47, ill., 1990). **T**: China, Anhui (Wang 9229 [Herb. Anhui Tradit. Medic. College]). - **D**: China (S Anhui); 200 - 850 m.

[1] Perennial herbs with erect non-flowering stems; **L** in whorls of 4 or 5, linear-spatulate to oblanceolate or (broadly) spatulate, obtuse to acute or retuse, shortly spurred or cuneate, (10-) 15 - 20 $\times$ (1.5-) 6 - 12 mm; flowering **Br** suberect, 10 - 20 cm, **L** alternate in the upper part; **Inf** many-flowered cymes with 3 or 4 cincinni; **Bra** **L**-like, 10 - 17 $\times$ 1.5 - 2 mm; **Ped** 0 - 2 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, unequal, linear-oblong, acute, 2 - 10 $\times$ 0.5 - 2 mm; **Pet** narrowly ovate to broadly lanceolate, acuminate, yellow, 6 - 9 mm; **Anth** red; **NSc** subflabellate, narrowed to the base; **Sty** $\pm$ 1 mm; **Fr** divergent; **Se** ellipsoid, reticulate-papillose.

Closely related to *S. emarginatum* and *S. jiulongshanense*.

S. kimnachii Byalt (KB 54: 458, 1999). **T**: CU. - **D**: Horticultural origin, probably C Mexican Plateau.

Incl. *Sedum decumbens* R. T. Clausen (1975) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum clausenii* Byalt (1998) (*nom. illeg.*, Art. 53.1).

[1] Perennial subshrubs with decumbent stems to 25 cm; **L** alternate, obovate to spatulate, rounded, emarginate, 15 - 25 $\times$ 11 - 13 mm; flowering **Br** erect or ascending, axillary; **Inf** small cymes with 3 or more **Br**; **Fl** 5-merous, subsessile; **Sep** basally slightly connate, shortly spurred, unequal, ovate,

obtuse to acute, green, $\pm$ 3 mm, erect; **Pet** free, ovate-lanceolate, yellow, $\pm$ 5 mm; **Se** probably reticulate.

Mostly still cultivated under the illegitimate name *Sedum decumbens*.

S. kingdonii H. Ohba (J. Jap. Bot. 50(12): 355-357, 1975). **T**: Myanmar (Kingdon Ward 22787 [GB, TI]). - **D**: Myanmar (Mt. Victoria); rocks and stony slopes.

[1] Small perennial herbs with slender erect to suberect stems; **L** alternate, subulate to narrowly ovate, acute, with a trilobate spur, fleshy, flat, 8 - 15.5 $\times$ 1.2 - 2 mm; flowering **Br** 5 - 10 cm, with few **Br** in the upper part; **Inf** shortly pedunculate cymes; **Bra** **L**-like; **Ped** 0.5 - 2.5 mm; **Fl** 5-merous, with (8-) 10 **St**; **Sep** broadly sessile, almost equal, linear-lanceolate, or rarely linear to linear-oblong, acute, flat, 3.5 - 5.2 $\times$ 0.8 - 1.2 mm; **Pet** narrowly ovate, obtuse, shortly mucronate, yellow, 5.1 - 7.2 mm; **Anth** yellow; **NSc** rectangular to subquadrate, rounded, rust-coloured; **Sty** to 1 mm.

Belonging to Sect. *Oreades* according to the protologue.

S. kotschyianum Boissier (Diagn. Pl. Orient. Ser. 1, 6: 56, 1845). **T**: Iran (Kotschy 423 [G-BOIS, W]). - **D**: Iran.

$\equiv$ *Sedum villosum* subvar. *kotschyianum* (Boissier) Hamet (1929) $\equiv$ *Oreosedum kotschyianum* (Boissier) Grulich (1984).

[2] Small annual herbs, glandular-pubescent in the upper parts, with slender erect stems, often branched in the upper part, to 4 cm tall; **L** alternate, shortly spurred, semiterete, linear-oblong, 2 - 4 mm, subobtusely; **Inf** few-flowered lax cymes; **Ped** filiform, 5 - 6 mm; **Fl** 5-merous, with 5 or 10 **St**; **Sep** broadly sessile, oblong to ovate, subacute, 1 - 1.5 mm; **Pet** oblong-elliptic to obovate, acute, 3 - 3.5 mm, pink; **Anth** red; **NSc** narrowly stipitate or spatulate, emarginate; **Sty** short; **Fr** erect to suberect, $\pm$ 3 mm, 3- to 4-seeded; **Se** oblong.

Ephemeral little-known Iranian endemic probably related to *S. callichroum*. A relationship with the W European or Atlantic *S. villosum* is very unlikely.

S. laconicum Boissier & Heldreich (in Boissier, Diagn. Pl. Orient. 1(6): 55, 1846). **T** [syn]: Greece, Peloponnisos (Heldreich s.n. [G-BOIS, L, LE, W]). - **D**: Greece, Lebanon, Israel. **Fig. XXXVI.d**

$\equiv$ *Sedum acre* var. *laconicum* (Boissier & Heldreich) Fröderström (1932) $\equiv$ *Sedum acre* ssp. *laconicum* (Boissier & Heldreich) J. A. Huber (1936); **incl.** *Sedum laconicum* fa. *elongatum* Pampanini (1936); **incl.** *Sedum laconicum* ssp. *pentapolitanum* Brullo & Furnari (1979).

[1] Perennial herbs with much-branched creeping and rooting stems crowded with imbricate **L** forming tufts of small **Ros**; **L** alternate, densely imbric-

cate, broadly linear or narrowly ellipsoid, sessile, with a narrow truncate spur, acute with hyaline papillae at the tip, subterete, bright glaucous-green, 5 - 8 mm; flowering **Br** erect or ascending, simple, 4 - 15 cm, with 1 - 10 small subsidiary axillary cymes; **Inf** usually dense few-flowered cymes with 2 - 3 cincinni; **Bra** 2 per **Fl**; **Fl** 5-merous, subsessile; **Sep** broadly sessile, linear-oblong, subacute or obtuse, sometimes with hyaline papillae, 2.5 - 3 mm; **Pet** free, lanceolate, apiculate-aristate, bright yellow, often with a red keel or red streaks, ± 6 mm; **Fil** yellow; **Anth** yellow (rarely red); **NSc** square; **Fr** stellately patent, brown, with pale conspicuous lips along the suture; **Se** pale brown, reticulate-papillose.

The largely disjunct circum-Aegean distribution of *S. laconicum* is very peculiar, with diploids (ssp. *laconicum*) on the Greek mainland, the Peloponnisos and Crete, tetraploids (ssp. *pallidum*) in Israel and the Lebanon, and the somewhat larger plants on the Cyrenaica (fa. *elongatum*) of which the chromosome number is still unknown. Reports of *S. laconicum* from Anatolia (Turkey) probably relate to *S. ursi* ($2n = 12$). *S. laconicum* belongs to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. laconicum ssp. **laconicum** – **D**: Greece incl. Crete; limestone, usually at higher altitudes.

Incl. *Sedum laconicum* var. *insulare* Rechinger fil. (1943) $\equiv$ *Sedum laconicum* ssp. *insulare* (Rechinger fil.) Greuter & Rechinger fil. (1967); **incl.** *Sedum idaeum* D. A. Webb (1961).

[1] **Pet** yellow. – *Cytology*: $2n = 16$.

Var. *insulare* from the mountains of Crete (Levka Ori) is a diminutive form with flowering stems 1 - 4 (-6) cm long and inflorescences with very few flowers; its anthers are sometimes red. It merely represents an extreme of a by and large continuous morphological series. Generally, the typical ssp. occurs over ± 1000 m, except in the S part of the Peloponnisos and on Kithira where it descends to sea-level. – [H. 't Hart]

S. laconicum ssp. **pallidum** 't Hart & van Ham (Israel J. Bot. 40: 325, 1991). **T**: Israel (van Ham 51.3 [U, HUI]). – **D**: Lebanon, Israel.

[1] **Pet** pale yellow to almost white. – *Cytology*: $2n = 32$. – [H. 't Hart]

S. lagascae Pau (Not. Bot. Fl. Españ. 6: 53, 1895). – **D**: W Spain (Sierras de Béjar y Gredos); moist places in alpine pastures, 1000 - 2000 m. **I**: Castroviejo (1997: 151, pl. 41: e-h).

$\equiv$ *Mucizonia lagascae* (Pau) Laínz (1968) $\equiv$ *Oreosedum lagascae* (Pau) Grulich (1984); **incl.** *Sedum francoi* Hamet (s.a.) (*nom. inval.*, Art. 32.1); **incl.** *Sedum villosum* var. *campanulatum* Willkomm (1874) $\equiv$ *Mucizonia campanulata* (Willkomm) R. Fernandes (1984) $\equiv$ *Sedum campanulatum* (Willkomm) Fernández González & Cantó (1985).

[1] Annual herbs, glandular-hairy, green or reddish; **R** fibrous; stems (6-) 8 - 16 (-25) cm, erect, branching; **L** alternate, linear, with a basal spur, 5 - 11 $\times$ 1 - 2.5 mm, glandular; **Inf** comprising at least $\frac{1}{2}$ of the length of flowering **Br**; **Fl** 5-merous; **Ped** 3 - 7 (-9) mm; **Sep** basally united, narrowly lanceolate, glandular, 1 - 2.5 $\times$ 0.4 - 0.8 mm; **Cl** campanulate-tubular; **Pet** basally united and forming a tube (2-) 3 (-4.5) mm long, elliptic, 5 - 8 $\times$ 1 - 2 mm, obtuse, white, pinkish or violet; **Ca** erect; **Se** 0.5 - 0.7 mm, costate.

A member of Ser. *Subrosea* and in the past sometimes confused with *S. villosum*, which differs by its stellate flowers. *S. lagascae* in the sense of Portuguese authors is referred to *S. maireanum* by Castroviejo (1997). – [U. Eggli]

S. lampusae (Kotschy) Boissier (Fl. Orient. 2: 787, 1872). **T**: Cyprus (Kotschy 471 [W]). – **D**: Cyprus (endemic to the Northern Range); rock walls, crevices and stony slopes on limestone, 200 - 750 m. **I**: CBM 180: 1-4, t. 660, 1974. **Fig.** XXXVI.a $\equiv$ *Umbilicus lampusae* Kotschy (1865).

[1] Monocarpic herbs, erect, (15-) 20 - 50 cm, forming flat and generally solitary **Ros** before flowering; **L** sessile, shrivelling at or soon after anthesis, flat, spatulate, 4 - 10 $\times$ 2 - 4 cm, acute or obtuse, glaucous, glabrous or thinly pubescent, margins minutely papillose, **L** of the **Inf** becoming gradually smaller and semiterete; **Inf** narrow unbranched cylindrical panicles to 30 cm, or at times pyramidal with several lateral **Br** towards the base, axes densely shortly glandular; **Bra** small; **Fl** very numerous, crowded, slenderly pedicellate up to 5 mm, 5-merous; **Sep** almost completely free, $\pm 1.5 \times 1$ mm, glandular; **Pet** narrowly ovate-acuminate, $\pm 4 \times 2$ mm, greenish or brownish-green; **Ca** erect, narrowly ovoid, glandular, ± 4 mm, tapering into the slender ± 1 mm long **Sty**; **Fr** erect; **Se** numerous, oblong-ellipsoid, $\pm 0.7 \times 0.4$ mm, medium brown, closely longitudinally costate.

Related to *S. cepaea* and very close to *S. cyprium* and *S. microstachyum*. – [U. Eggli]

S. lanceolatum Torrey (Ann. Lyceum Nat. Hist. New York 2: 205-206, 1828). **T**: USA (James s.n. [NY]). – **D**: Canada, USA.

$\equiv$ *Amerosedum lanceolatum* (Torrey) A. Löve & D. Löve (1985); **incl.** *Sedum shastense* Britton (1903).

[2] Tufted glabrous perennial herbs with branching, sometimes papillose, decumbent stems; **L** alternate, lanceolate, elliptic-lanceolate or elliptic-ovate, obtuse or obtusely apiculate, subterete, sessile with very short spurs, 4.4 - 10.6 $\times$ 1.5 - 3.2 mm, sometimes papillose, dull grey-green or bluish-green, often glaucous; base of withered **L** at times becoming scarious; flowering **Br** erect, 3 - 10 cm; **Inf** (1- to) 3- (to 6-) branched cymes; **Bra** L-like; **Fl** 5-merous, sessile or subsessile; **Sep** broadly

sessile, ovate or lanceolate, acute or rarely obtuse, often papillose, pale green to yellow-green, $\pm 3 \times 1.5$ mm, erect; **Pet** free, lanceolate, elliptic-lanceolate or linear-lanceolate, acute or acuminate, minutely mucronate, canaliculate, canary- to golden-yellow, ± 7.5 mm, widely spreading from the suberect base; **Fil** yellow; **Anth** yellow, sometimes suffused with red; **NSc** obovately square, truncate or broadly rounded, emarginate or reniform, deep yellow to yellow-green; **Fr** basally connate, erect, with divergent beaks and narrow lips along the ventral suture, brown; **Se** pear-shaped, yellow-brown to dark brown, costate. – *Cytology*: $2n = 16$.

Fröderström (1936a: 68) treats this taxon as a synonym of *S. stenopetalum*.

S. lanceolatum ssp. **lanceolatum** – **D**: NW Canada, W USA (to California in the S); to 3660 m. **I**: Clausen (1975: 212).

[2] Plants of medium size, adapted to growing seasons of > 3 months; **L** papillose, $4 - 9 \times 1.5 - 2.5$ mm; **Sep** $2 - 4$ mm; **Pet** $6 - 9$ mm.

At higher altitude this subspecies could be confused with ssp. *subalpinum*.

S. lanceolatum ssp. **nesioticum** (G. N. Jones) R. T. Clausen (CSJA 20(10): 146, 1948). **T**: USA, Washington (*Henderson* 1686 [GH]). – **D**: W-most Canada and USA, on islands in the Puget Sound and the Straits of Georgia and adjacent Vancouver Island.

$\equiv$ *Sedum nesioticum* G. N. Jones (1941) $\equiv$ *Sedum stenopetalum* ssp. *nesioticum* (G. N. Jones) R. T. Clausen (1946) $\equiv$ *Sedum lanceolatum* var. *nesioticum* (G. N. Jones) C. L. Hitchcock (1964) $\equiv$ *Amerosedum nesioticum* (G. N. Jones) A. Löve & D. Löve (1985).

[2] Plants of large size, flowering ± 2 weeks later in the season than the other 2 spp.; **L** $8 - 13 \times 3 - 3.5$ mm; **Sep** $4 - 5$ mm; **Pet** ± 9 mm.

S. lanceolatum ssp. **subalpinum** (Blankinship) R. T. Clausen (*Sedum* North Amer., 231, 1975). **T**: USA, Montana (*Blankinship* s.n. [MONT ?]). – **D**: Canada, USA; Rocky Mountains to Alaska in the N; mostly on exposed alpine sites in gravel or stony loam, 1950 - 4050 m.

$\equiv$ *Sedum subalpinum* Blankinship (1905) $\equiv$ *Amerosedum subalpinum* (Blankinship) A. Löve & D. Löve (1985); **incl.** *Sedum stenopetalum* fa. *rubrolineatum* Cockerell (1891); **incl.** *Sedum stenopetalum* var. *alpinum* Fröderström (1936).

[2] Plants of small size, adapted to growing in alpine habitats with short (< 2 months) growing season; **L** sometimes papillose, $4.2 - 6.7 \times 1.5 - 2$ mm; **Sep** $2 - 4$ mm; **Pet** $6 - 9$ mm.

S. lancerottense Murray (J. Bot. 37: 201, 1899). **T**: BM?. – **D**: Canary Islands (N Lanzarote, Famara region). **I**: 't Hart (1999a). **Fig.** XXXVI.e

$\equiv$ *Sedum nudum* var. *lancerottense* (Murray) Fröderström (1932).

[1] Glabrous perennial herbs, non-flowering shoots slender, much-branched, trailing and ascending, basally somewhat woody, rooting, 5 - 10 cm tall, forming small tufts or loose mats; **L** alternate, sessile, crowded at the **Br** tips, subovate to ovate, 5 - 6 mm, rounded, terete to subterete, pale green, often with a silvery hue; flowering **Br** erect or ascending to 10 cm tall; **Inf** few-flowered cymes with 2 - 3 short cincinni; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile or shortly pedicellate; **Sep** basally free, spurred, unequal, ovate, ± 4 mm, rounded; **Pet** free, oblong, 5 - 6 mm, acute, pale yellow; **Fil** yellow; **Anth** yellow; **NSc** spatulate, yellowish; **Fr** substellate to stellately patent, yellowish-brown, with lips along the suture; **Se** pale brown, reticulate-papillose. – *Cytology*: $2n = 26$.

A distinct species belonging to the comparium of Ser. *Macaronesia* Fröderström. – [H. 't Hart]

S. latentibulosum K. T. Fu & G. Y. Rao (Acta Bot. Boreal.-Occid. Sin. 8(2): 121-123, ill., 1988). **T**: China, Jiangxi (*Fu* 19565 [WUG]). – **D**: China (N Jiangxi: Lushan Mts.); moss-covered rocks, 800 - 900 m.

[1] Perennial herbs with slender elongate stems, 12 - 18 cm, with oblong underground bulbils at the lower nodes; **L** opposite at the base, in whorls of 4 in the middle and alternate towards the stem tip, narrowly linear, obtuse, shortly spurred, subterete, $12 - 30 \times 1 - 1.5$ mm; flowering **Br** slender, 10 - 16 cm; **Inf** lax few-flowered cymes with 3 cincinni; **Bra** linear; **Fl** 5-merous, sessile; **Sep** shortly spurred, narrowly to triangular-lanceolate, obtuse to acute, speckled with brown, $2 - 2.5 \times \pm 1$ mm; **Pet** linear-lanceolate, mucronate, $\pm$ broadened at the base, yellow, 6 - 7 mm; **NSc** slightly spatulate, rounded; **Sty** to 1.5 mm; **Se** oblong.

S. latifilamentum R. T. Clausen (Bull. Torrey Bot. Club 106: 213-214, ill., 1979). **T**: Mexico, Hidalgo (*Clausen* 78-15 [BH]). – **D**: Mexico (Hidalgo).

[1] Perennial subshrubs with tuberous napiform **R**; **L** alternate, linear-oblongate, papillose, $\pm 7 \times 1.5$ mm; flowering **Br** erect; **Inf** cymes with 3 **Br**; **Fl** 5-merous; **Pet** basally slightly connate (0.4 mm), ovate with narrowed base, subterete, white, ± 4 mm, erect then spreading; episealous **Fil** broad and flattened; **NSc** square, stipitate, truncate, yellow; **Sty** none; **Fr** divergent, with lips along the ventral suture; **Se** pear-shaped, reticulate-papillose. – *Cytology*: $2n = 40$.

S. laxum (Britton) A. Berger (NPF2 18a: 451, 1930). **T**: USA, Oregon (*Howell* s.n. [US]). – **Lit**: Denton (1978). **D**: W USA.

$\equiv$ *Gormaniana laxa* Britton (1903); **incl.** *Cotyledon brittoniana* Fedde (1904); **incl.** *Echeveria gormanii* Nelson & Macbride (1913); **incl.** *Sedum laxum* ssp. *perplexum* R. T. Clausen (1942).

[2] Glabrous perennial herbs with stout branched **R**stocks forming terminal **Ros**; **L** alternate, oblanceolate, spatulate or obovate, rounded, emarginate or retuse, 14.5 - 36 × 7.5 - 17 mm, glaucous or green; flowering **Br** 7 - 26 cm; **Inf** elongate cymes with 3 or more monochasial **Br**; **Ped** 0.6 - 6.3 mm; **Fl** 5-merous; **Sep** broadly sessile, basally slightly connate, ovate or lanceolate, acute, rarely obtuse, pale green, ± 3.5 × 2 mm; **Pet** basally connate, lanceolate-oblong, oblanceolate-oblong or elliptic-oblong, obtuse, shortly mucronate or aristate, whitish to pink, ± 9 mm, basally erect, divergent above the middle; **Fil** white, greenish-white or pink; **Anth** red or yellow; **NSc** reniform or transversely oblong, deeply concave to truncate at the tip, white, yellow or pink; **Fr** erect, brown; **Se** pear-shaped, brown, costate.

S. laxum ssp. **eastwoodiae** (Britton) R. T. Clausen (*Sedum* North Amer., 398, 1975). **T**: USA, California (*Eastwood* s.n. [US, CAS 34297, NY]). – **D**: W USA (California: N Mendocino County); only on serpentine, 1050 - 1170 m.

≡ *Gormania eastwoodiae* Britton (1903) ≡ *Sedum eastwoodiae* (Britton) A. Berger (1930); **incl.** *Cotyledon mendocinoana* Fedde (1904) (*nom. illeg.*, Art. 52.1).

[2] Differs from ssp. *laxum*: **L** 9 - 17 mm wide, glaucous; flowering **Br** 4 - 13 cm; **L** with cordate bases, not clasping the stem; **Ped** of basal **Fl** to 4 mm; **Sep** 2 - 4.1 mm; **Pet** pink or white, 4 - 8 mm; **Anth** red or yellow; **NSc** 0.8 - 1.4 mm wide. – *Cytology*: 2n = 60.

S. laxum ssp. **flavidum** Denton (Brittonia 30(2): 233-235, ill., 1978). **T**: USA, California (*Denton* 3953 [WTU]). – **D**: USA (California: Trinity Mts.); serpentine or basalt outcrops, 750 - 900 m.

[2] Differs from ssp. *laxum*: Plants 9 - 24 cm tall; rosette **L** 15 - 25 × 4.5 - 10 mm, 2 - 3.5× as long as wide; stem **L** ± as long as broad, base often truncate, tip obtuse, green and slightly glaucous; **Sep** < ½ as long as the **Pet**, obtuse; **Pet** pale yellow. – *Cytology*: 2n = 60. – [U. Eggli]

S. laxum ssp. **heckneri** (M. Peck) R. T. Clausen (Bull. Torrey Bot. Club 69(1): 39, 1942). **T**: USA, Oregon (*Peck* 16421 [WILLU]). – **D**: W USA (California: Klamath Mts., S Siskiyou Mts.); on serpentine, 150 - 1770 m. **I**: Clausen (1975: 391).

≡ *Sedum heckneri* M. Peck (1937).

[2] Differs from ssp. *laxum*: **L** relatively thick; **L** of flowering **Br** cordate, clasping the stem, nearly suborbicular; **Ped** of basal **Fl** 4 - 7 mm; **Pet** pink, white or yellowish-white; **Anth** yellow. – *Cytology*: 2n = 30.

S. laxum ssp. **latifolium** R. T. Clausen (Bull. Torrey Bot. Club 69(1): 38-39, 1942). **T**: USA, California (*Clausen* 4941 [BH]). – **D**: W USA (Califor-

nia: drainage of the Smith River); 60 - 550 m. **I**: Clausen (1975: 395).

[2] Differs from ssp. *laxum*: **L** obovate, 17 - 30 mm wide, relatively thick, deeply emarginate, green; **L** of flowering **Br** cordate, not clasping the stem; **Ped** of basal **Fl** to 4 mm; **Pet** pink or white; **Anth** red or yellow; **NSc** 0.8 - 0.9 mm wide. – *Cytology*: 2n = 30.

This is the most robust of all the subspecies. It is regarded as synonymous with ssp. *laxum* by Denton (1978).

S. laxum ssp. **laxum** – **D**: W USA (SW Oregon: Rogue River; NW California); mostly on serpentine, to 1220 m. **I**: Clausen (1975: 380).

incl. *Sedum jepsonii* Butterfield (1936) (*nom. inval.*, Art. 36.1); **incl.** *Sedum laxum* ssp. *typicum* R. T. Clausen (1942) (*nom. inval.*, Art. 24.3).

[2] **L** spatulate or oblanceolate, 10 - 50 × to 17 mm, much longer than wide, glaucous; flowering **Br** 15 - 26 (-40) cm, **L** obtuse, not clasping the stem; **Ped** of basal **Fl** to 4 mm; **Sep** 3.5 - 5.1 mm; **Pet** pink or white, 9 - 11 mm; **Anth** red or yellow; **NSc** 0.8 - 1.4 mm wide. – *Cytology*: 2n = 30. – [H. 't Hart, B. Bleij & U. Eggli]

S. leblanciae Hamet (RSN 8: 311-313, 1910). **T**: China, Yunnan (*Delavay* 6726 [P]). – **D**: China (SW Sichuan, NW Yunnan); rocks in forests, rock walls, among mosses on limestone rocks, 1500 - 3500 m. **I**: Fröderström (1931: 75, t. 42). Fu & Fu (1984: t. 28).

[1] Perennial herbs with erect stems, branched from near the base, mamillate towards the tip, 3.5 - 13 cm; **L** in whorls of 4 at the base, alternate in the upper part, linear to broadly oblanceolate, mamillate towards the tip, 4 - 8 mm; **Inf** rather dense corymbs; **Fl** 5-merous, on short pedicels, with 5 - 10 **St**; **Sep** broadly sessile, unequal, linear-spatulate, rounded to obtuse, mamillate towards the tip, 2.5 - 5 mm; **Pet** oblong to semi-ovate, mucronate or subacute, colour not described, 4 - 8 mm; **NSc** broadly linear-spatulate, emarginate; **Fr** erect; **Se** reticulate-papillose.

Fröderström (1931) distinguished two varieties (var. *dielsii*, var. *torquatum*). These are here classified as *S. dielsii* and *S. tsiangii* var. *torquatum*.

S. leibergii Britton (North Amer. Fl. 22(1): 73, 1905). **T**: USA, Oregon (*Cusick* 846 [GH]). – **D**: NW USA (Oregon, Washington, Idaho); mostly on basalt or limestone, 260 - 1200 m. **I**: Fröderström (1936a: 116, t. 78); Clausen (1975: 282).

≡ *Amerosedum leibergii* (Britton) A. Löve & D. Löve (1985); **incl.** *Sedum divaricatum* S. Watson (1882) (*nom. illeg.*, Art. 53.1).

[2] Biennial herbs with slender **R**stock and basal **Ros**, axillary shoots with subterranean short white stems, which detach easily and bear tiny terminal **Ros** of colourless **L**; **L** alternate, oblanceolate, ob-

ovate or narrowly spatulate, papillose, $\pm 9.5 \times \pm 2.3$ mm; outermost lower **Ros L** very long petiole; flowering **Br** erect, ± 11 cm; **Inf** cymes with 3 - 6 **Br**, each **Br** $1\times$ or $2\times$ dichotomously forked; **Fl** 5- to 6- (to 7-) merous or more, subsessile; **Sep** broadly sessile, basally slightly connate, ovate, acute, green, $1.5 - 2 \times \pm 1$ mm; **Pet** nearly free to the base, lanceolate to oblong, subobtuse to acute, carinate, canary-yellow with green or dark red keel, ± 5.5 mm; **Fil** yellow; **Anth** yellow; **NSc** subquadrate, slightly emarginate, deep yellow; **Fr** stellate, basally connate, glandular, verrucose, brown; **Se** pear-shaped, yellow-brown, costate. – *Cytology*: $2n = 16$.

The large variation in the number of floral parts (5 - 7 or more) is notable.

S. lenkorianum Grossheim (Vestn. Tiflissk. Bot. Sada 3-4: 173, 1915). **T**: Azerbaidzhan (Grossheim s.n. [LE]). – **D**: Turkey, Armenia, Azerbaidzhan, N Iran; rocky places in high mountain zones. **I**: Akhiani (2000: 27).

Glabrous tufted perennial herbs with branched shoots to (5-) 15 (-20) cm long; **L** alternate, densely imbricate, subulate, 3 - 6 mm, terete, obtuse; flowering **Br** erect; **Inf** subcorymbiform with 2 or 3 **Br**, few-flowered; **Bra L**-like; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, basally connate, oblong-lanceolate, ± 2 mm, subobtuse; **Pet** lanceolate, 6 - 7 mm, acuminate, white or pinkish; **Fil** white; **Anth** dark red; **Fr** erect; **Se** elongate-ovoid, light brown, costate.

Most probably merely a large form of *S. gracile*.

S. lenophylloides Rose (CUSNH 13(9): 298-299, 1911). **T**: Mexico, Nuevo León (Pringle s.n. [US 574882]). – **D**: Mexico (Nuevo León); ± 1000 m. **I**: Fröderström (1936a: 41, t. 25).

[1] Glabrous perennial subshrubs with strictly erect stems, 5 - 35 cm tall; **L** closely set, alternate, oblong, (sub-) acute, very turgid, 10 - 15 mm, often purplish, spreading; flowering **Br** erect; **Inf** lax few-flowered panicles; **Bra** lanceolate, small; **Fl** 5-merous, subsessile; **Sep** basally free, shortly spurred, equal, oblong, subacute, ± 2 mm, suberect; **Pet** nearly free to the base, oblong, obtuse, shortly mucronate, greenish-white, 5 - 6 mm, suberect; **NSc** large, square-subspatulate, flat, orange; **Sty** long; **Fr** suberect.

Related to *S. calcicola* and *S. acropetalum*.

S. leptophyllum Fröderström (in Handel-Mazzetti, Symb. Sin. 7: 412, 1931). **T**: China, Zhejiang / Anhui (Chien 1233 [W]). – **D**: China (S Anhui, SE Hubei, Hunan, NW Zhejiang); ± 1300 m. **I**: Fröderström (1931: 101, t. 65). Fu & Fu (1984: t. 30).

[1] Perennial herbs with slender erect stems 8 - 10 cm; **L** usually in whorls of 3, narrowly linear-oblongate, obtuse, mamillate at the tip, 5 - 25 mm; flowering **Br** slender, **L**-less in the lower part,

15 - 20 cm; **Inf** lax cymes with 3 often forked cincinni; **Bra** linear, 6 - 20 mm; **Fl** 5-merous; **Sep** broadly sessile, triangular, obtuse, nodulate near the tip, ± 1 mm; **Pet** basally connate to 1 mm, lanceolate, subobtuse, submucronate, pale yellowish, 4.5 - 5 mm; **NSc** broadly spatulate-subquadrate; **Ca** 3 mm; **Fr** divergent, basally connate for 1 - 1.5 mm, few-seeded.

S. leucocarpum Franchet (J. Bot. (Morot) 1896: 288, 1896). **T**: China (Delavay 2515 [not located]). – **D**: China (SW Sichuan, NW Yunnan); rocks in valleys, 1600 - 2800 m. **I**: Fröderström (1931: 91-92, t. 58); Fu & Fu (1984: t. 31).

Incl. *Sedum varicolor* Praeger (1921).

[1] Perennial herbs with short **R**stock and short basally persistent and woody stems; **L** alternate, subimbricate, spatulate-oblong, subobtuse, 5 - 20 mm; flowering **Br** minutely roughened, 4 - 15 cm; **Inf** flat, corymbose; **Fl** 4- or 5-merous; **Sep** broadly sessile, very unequal, narrowly triangular to broadly lanceolate, subobtuse, 1 - 5.5 mm; **Pet** semi-oblong, shortly mucronate, yellowish, 4 - 5.5 mm; **NSc** oblong to square, slightly emarginate; **Sty** rather long; **Fr** stellately divergent, basally connate for ± 1 mm; **Se** reticulate-papillose.

According to Fröderström (1931) the roughness of the branches of *S. leucocarpum* appears to be similar to the pubescence of the stems of *S. gajai*.

S. liebmännianum Hemsley (Diagn. Pl. Nov. Mexic. 12, 1878). **T**: Mexico, Oaxaca (Liebmänn & Gregg 664 [K]). – **D**: S USA (W Texas) to SE Mexico (Oaxaca); ± 2500 m. **I**: Fröderström (1936a: 88, t. 55).

Incl. *Sedum marcescens* Rose (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sedum havardii* Rose (1905).

[1] Perennial herbs or subshrubs with procumbent creeping spreading stems, with ascending or erect **Br** to 15 cm; **L** imbricate to subimbricate, alternate, suboblong to ovate, obtuse, broad at the base, shortly spurred, smooth or papillose, 4 - 6 mm; flowering **Br** erect; **Inf** small cymes; **Fl** 5-merous, sessile or subsessile; **Sep** basally free, long spurred, slightly unequal, linear or lanceolate, obtuse, fleshy, 3 - 5 mm, erect to suberect; **Pet** basally free, suboblong, obtuse, shortly mucronate, white, 5 - 6.5 mm, spreading; **Anth** red or purplish; **NSc** broader than long, emarginate; **Sty** rather long; **Fr** substellately spreading, turgid; **Se** ovoid, reticulate-papillose. – *Cytology*: $2n = \pm 36 - 50, \pm 40, \pm 50, 68, 68 - 72$.

S. lineare Thunberg (Fl. Jap., 187, 1784). **T**: not located. – **D**: SE China, Japan; low mountains, rocks on grassy slopes etc.; probably naturalized in E Europe. **I**: Fröderström (1931: 88, t. 53-54); Fu & Fu (1984: t. 32). **Fig. XXXVI.f**

Incl. *Sedum lineare* var. *floribundum* Miquel (1866); **incl.** *Sedum lineare* var. *minus* Miquel

(1866); **incl.** *Sedum obtuso-lineare* Hayata (1913); **incl.** *Sedum lineare* fa. *variegatum* Praeger (1921); **incl.** *Sedum lineare* var. *robustum* Praeger (1921); **incl.** *Sedum lineare* var. *albomarginatum* Makino ex Megata (1952).

[1] Perennial herbs with ascending very slender fleshy stems 10 - 30 cm; **L** in whorls of 3 - 4, linear to broadly oblanceolate, obtuse to subacute, rather flat, 7 - 30 × ± 2 mm; flowering **Br** ascending, very slender; **Inf** lax few- to many-flowered cymes of (1-) 2 (-3) sometimes forked cincinni; **Bra** linear; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, often unequal, linear-lanceolate, subobtusate to subacute, 1.5 - 7 (-11) × 2 mm; **Pet** oblong, subobtusate, shortly mucronate, slightly narrowed at the base, yellow, 4 - 9 mm; **NSc** square-spatulate; **Sty** short; **Fr** divergent; **Se** reticulate-papillose. – *Cytology*: $n = 36$ (Uhl & Moran 1972).

Fröderström (1931) included *S. subtile* and *S. zentaro-tashiroi* into the synonymy here. Ohwi (1965: 497) considered the latter as a synonym of *S. subtile*, which he regarded as distinct from *S. lineare*. Fu & Fu (1984: 144, 157) also treated *S. lineare* and *S. subtile* as distinct species. They gave *S. obtuso-lineare* as a synonym of *S. lineare*, while Tang & Huang (1989), however, considered *S. obtuso-lineare* as a synonym of *S. mexicanum*, whose purported American origin still has to be ascertained. Finally, Fu & Ohba (2001: 249-250) treat *S. obtuso-lineare* as synonym of *S. yvesii* and interpret *S. anhuiense* as further synonym of *S. lineare*.

Praeger (1921a) distinguished a large form of *S. lineare* as var. *robustum*. Generally, *S. lineare* var. *contractum* is included in *S. sarmentosum*, whereas *S. lineare* var. *floribundum* is either included in *S. alfredii* or *S. bulbiferum*.

Whether this species is really indigenous in Japan remains doubtful according to Ohba (2001: 29), although it was originally described on the base of material from that country.

In cultivation, an attractive white-green variegated form is sometimes encountered (fa. *variegatum* Praeger).

S. litoreum Gussone (Pl. Rar., 185, 1826). – **D**: Throughout most of the C and E Mediterranean region incl. the Near East, S Europe and the Cyrenaica, and also reported from the French Atlantic coast; common in rocky places in the littoral zone.

Incl. *Sedum littoreum* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Sedum rhytidocalyx* P. Candargy (1897).

[1] Glabrous erect annual herbs 1 - 15 cm tall, usually simple or branched from the base; **L** alternate, oblong-elliptic to obovate, obtuse, semiterete or terete, without basal spur, to 10 mm or more, bright green; **Inf** (1- to) 2- (to 4-) branched cymes with (2-) 7 - 13 (-25) sessile **Fl**; **Bra** 2 per **Fl**; **Fl** 5-merous, subsessile; **Sep** broadly sessile, 1.8 - 2 mm, basally connate, strongly unequal; **Pet** pale yellow

or greenish, spreading; **Fil** yellow, glabrous; **Anth** red (rarely yellow); **NSc** oblong, emarginate; **Fr** spreading, usually with narrow lips along the suture, brown; **Se** ellipsoid-ovoid, dark brown, bipapillate.

This is the type of the monotypic Ser. *Litorea* 't Hart ('t Hart 1991). *S. cilicicum* is a close ally. – [H. 't Hart & U. Eggli]

S. litoreum var. **creticum** 't Hart (Ot Sist. Bot. Dergisi 2(2): 3, 1996). **Nom. inval.**, Art. 37.6. **T**: Greece, Crete ('t Hart 27274 [U]). – **D**: Greece (Crete, recently also reported from Armathia Island in the Karpathos group).

Incl. *Sedum praesidis* Runemark & Greuter (1981) ≡ *Sedum litoreum* ssp. *praesidis* (Runemark & Greuter) Greuter (1992).

[1] **Fl** outbreeding with 10 **St** and superior **Ov**; **Sep** connate only at the very base; **Pet** 4 - 6 mm; **Anth** oblong, large, bright red (rarely yellow); **Sty** ± 1 mm. – *Cytology*: $2n = 20$.

Generally, var. *creticum* prefers less exposed, more mesic or shaded habitats, but the 2 varieties often occur in close proximity or even in mixed stands. – [H. 't Hart]

S. litoreum var. **litoreum** – **D**: Throughout the range of the species.

Incl. *Sedum stellatum* Urville (1822) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum marichalii* Lloyd (1851); **incl.** *Sedum barcense* Maire & Weiller (1939) ≡ *Sedum litoreum* var. *barcense* (Maire & Weiller) Maire (1977); **incl.** *Sedum litoreum* var. *eu-litoreum* Maire (1977) (*nom. inval.*, Art. 36.1, 37.1).

[1] **Fl** with 5 **St** (rarely more or 10) and **Ov** partly immersed into the **Rec** or semi-inferior; **Sep** basally distinctly connate; **Pet** ± 3.2 mm; **Anth** small, globular, red or dark red; **Sty** short, to 0.3 mm. – *Cytology*: $2n = 20, 40, 60$.

Diploid plants ($2n = 20$) have only been reported from Crete and the E Peloponnisos (Argolis). They are usually small and few-flowered. The tetraploid cytotype ($2n = 40$) is known from Greece (incl. Crete) and Israel, whereas hexaploids ($2n = 60$) occur throughout the area of the species. Hexaploid plants are generally robust with large flowers in many-flowered inflorescences ('t Hart, unpublished results). – [H. 't Hart]

S. longifuniculatum K. T. Fu (Acta Phytotax. Sin. 12(1): 70-71, t. 19-27, 1974). **T**: China, Sichuan (Chow & Chang 23776 [PE]). – **D**: China (NC Sichuan); grassy places on summits, ± 4200 m. **I**: Fu & Fu (1984: t. 27).

[1] Annual herbs with erect to subarcuate stems, simple or branched at the base, 5 - 12 cm tall; **L** alternate, linear-oblong, obtuse, shortly spurred, 3 - 12 × 1 - 2 mm; **Inf** many-flowered corymbs; **Bra** L-like; **Ped** 1.5 - 5 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, unequal, linear-oblong, ob-

tuse, 5.5 - 6.5 × 1.2 - 1.5 mm; **Pet** basally slightly connate, suboblong, shortly mucronate, yellow, ± 7 mm; **Anth** yellow; **NSc** linear-spatulate, upper part transversely oblong to nearly rounded, slightly emarginate; **Fr** erect to divergent, few-seeded; **Se** obovate, reticulate-papillose.

S. longipes Rose (Bull. New York Bot. Gard. 3(9): 43, 1903). **T:** Mexico, Morelos (*Pringle* 8049 [US, ENCB]). – **D:** Mexico.

[1] Perennial herbs with short **R**stock and repent finely papillose stems; **L** alternate, elliptic, oblanceolate or obovate, rounded, narrowly spurred, papillose esp. marginally, subterete, 4.5 - 15.4 × 1.5 - 7 mm, often recurved; flowering **Br** erect; **Inf** lax cymes; **Ped** 5 - 24 mm; **Fl** 5-merous; **Sep** basally free, broadly spurred, unequal, lanceolate, elliptic-oblong, ovate-elliptic or elliptic, acute, papillose at the tips, pale green, 3.1 - 5.5 × 1.2 - 2.1 mm, suberect; **Pet** basally free, lanceolate, ovate or elliptic-oblong, spreading, acute to mucronate, pale green to purplish, ± 5 mm; **Anth** red, orange or yellow; **NSc** obovate, bilobed or lacerate, dark red speckled with yellow; **Fr** erect, with tiny marginal lips; **Se** ellipsoid, glabrous, brown, smooth. – *Cytology*: 2n = 38, 39, 40.

S. longipes ssp. **longipes** – **D:** Mexico (C and E Trans-Mexican Volcanic Belt); 1800 - 2900 m. **I:** Clausen (1959: 199). **Fig. XXXVI.g**

[1] **Ros** when present usually with compactly arranged **L**; **Pet** 5.3 - 5.5 mm, longer than the **Sep**.

S. longipes ssp. **rosulare** R. T. Clausen (Sedum Trans-Mex. Volcanic Belt, 199-200, ill., 1959). **T:** Mexico, Puebla (*Clausen* CU 1 [CU]). – **D:** Mexico (cultivated in Puebla and Veracruz).

[1] Differs from ssp. *longipes*: **Ros** prominent with widely divergent **L**; **Pet** 3.7 - 4.1 mm, equal or shorter than the **Sep**.

S. longyanense K. T. Fu (Acta Bot. Boreal.-Occid. Sin. 6(2): 108-110, ill., 1986). **T:** Tibet (*Tsoong* 5272 [PE]). – **D:** E Tibet; among moss on rocks.

[1] Perennial herbs with tiny stems to 1.2 cm; **L** alternate, narrowly semi-oblong, **Sc**-like on basal stem parts and elongating upwards, shortly spurred, 3 - 7 × 1 - 1.6 mm, mucronate, speckled with brown along the veins; flowering **Br** arcuate, simple, glabrous, to 10 cm; **Inf** 5- to 12-flowered cymes with 1 or 2 cincinni; **Ped** 1 - 3 mm; **Fl** 5-merous; **Sep** basally free with a short obtuse spur, oblong-lanceolate to lanceolate, acuminate to mucronate, 3-veined, speckled with brown along the veins, 3.5 - 4 × 0.7 - 0.9 mm; **Pet** almost free to the base, linear to linearly semi-oblong, mucronate, yellow with a brown mucro, ± 6 mm; **NSc** linear-oblong, obtuse to rounded; **Fr** suberect with 6 - 8 ovate smooth **Se**.

S. ×lorenzoii 't Hart (BJS 109(1): 8-10, ill. (p. 5),

1987). **T:** France, Charente ('t Hart 28539 [U]). – **D:** France.

[1] = *S. ochroleucum* × *S. rupestre*. Intermediate between the parents; flowering **Br** 15 - 30 cm; **Inf** glandular-pubescent or glabrous, bracteate; **Fl** 5- to 7-merous, sessile; **Pet** pale yellow; **Fil** pale yellow.

S. ×lorenzoii nssp. **hommelsii** ('t Hart) 't Hart (Sedum Soc. Newslett. No. 28: 20, 1993). **T:** France, Hautes Alpes ('t Hart 22555 [U]). – **D:** France (Hautes Alpes: only known from the valley of the river Durance).

≡ *Sedum ×hommelsii* 't Hart (1987) (*incorrect name*, Art. 11.3, H4, H5).

[1] = *S. ochroleucum* × *S. rupestre* ssp. *erectum*. Flowering **Br** 15 - 25 cm; **Inf** erect in bud, glabrous; **Sep** 4.5 mm; **Pet** ± 9 mm, suberect; **Fil** glabrous. – *Cytology*: 2n = 82.

S. ×lorenzoii nssp. **lorenzoii** – **D:** France (Charente: only known from the type locality near Cognac).

[1] = *S. ochroleucum* × *S. rupestre* ssp. *rupestre*. Flowering **Br** 17 - 30 cm; **Inf** drooping in bud, sparsely glandular-pubescent; **Sep** ± 4 mm; **Pet** ± 8.5 mm, suberect to spreading; **Fil** basally papillate. – *Cytology*: 2n = 124, 146.

S. luchuanicum K. T. Fu (Acta Phytotax. Sin. 12(1): 65-66, t. 12: 10-19, 1974). **T:** China, Yunnan (*Chang* 588 [PE]). – **D:** China (NC Yunnan); rock crevices, ± 4400 m. **I:** Fu & Fu (1984: t. 26).

[1] Slender densely leafy annual herbs, branched from the base, 5 - 9 cm tall; **L** alternate, subulate, linear-lanceolate to narrowly triangular-lanceolate, acuminate, with a short broadly trilobate truncate spur and speckled veins, 1 - 7 × 1 - 2 mm; **Inf** dense 3- to 9-flowered corymbs; **Bra** **L**-like but slightly larger; **Fl** 5- or 6-merous; **Sep** basally free, with a long, obtuse spur, linear-lanceolate to semi-lanceolate, acuminate, with speckled veins, 5.8 - 7.5 × ± 2 mm; **Pet** basally connate up to 0.7 mm, linear-lanceolate, long mucronate, purple, 9 - 10 mm; **NSc** broadly spatulate, obtuse; **Sty** to 2 mm; **Se** obovate, reticulate-papillose.

Close to *S. paracelatum*, but different by its purple flowers, free carpels and sublunate placentation.

S. lucidum R. T. Clausen (CSJA 23(4): 125-127, ill., 1951). **T:** Mexico, Veracruz (*Walther* C44-12 [CU]). – **D:** Mexico (E Sierra Madre del Sur). **Fig. XXXVII.b**

[1] Perennial subshrubs with much branched stems, to 45 cm tall; **L** alternate, obovate or oblanceolate to elliptic, rounded, obtuse or acute, sometimes apiculate, carinate, slightly angulate, subterete, upcurved, lustrous, green, 12 - 55 × 7 - 23 mm, 3 - 13 mm thick; flowering **Br** ascending, axillary or perhaps terminal; **Inf** cymes with 2 - 14 **Br**, mostly paniculate; **Ped** 1 - 7 mm, thickened up-

wards; **Fl** 5-merous; **Sep** basally connate, rarely spurred, ovate or oblong, obtuse to narrowly rounded, green, 2 - 4.9 × 0.8 - 2.1 mm, erect; **Pet** basally slightly connate, lanceolate or elliptic-oblong, obtuse, mucronate, white, rarely pinkish-white, ± 7 mm, erect then spreading, upcurved towards the tips; **Fil** white; **Anth** yellow; **NSc** square, emarginate, pale yellow or white; **Fr** erect, with small lips along the ventral suture. – *Cytology*: 2n = 68.

Flowering branches appear apparently lateral as well as terminal (Clausen 1959: 96).

S. lumboltzii B. L. Robinson & Fernald (Proc. Amer. Acad. Arts 30: 116, 1894). **T** [syn]: Mexico, Sonora (*Hartman* 287 [GH]). – **D**: Mexico (Sonora, Sinaloa), ± 1200 m. **I**: Fröderström (1936a: 48, t. 30); *Sedum* Soc. Newslett. 54: pl. 48-49, 2000.

[1] Perennial ± tufted herbs with rather stout **R**-stock and elongate slender sterile stems, densely leafy in the upper part; **L** alternate, obovate to oblanceolate, shortly apiculate or (sub-) acute, shortly spurred, papillose, 6 - 14 mm; flowering **Br** erect or recurved, slender, granular-pubescent above, glabrous below, 4 - 15 cm long; **Inf** lax many-flowered corymbs; **Bra** L-like; **Ped** 2 - 6 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, slightly unequal, broadly linear to oblong, subobtusate, pubescent, ± 3 mm, suberect; **Pet** basally slightly connate, oblong, subacute, narrowly mucronate, slightly narrowed at the base, pubescent along the midrib, white, ± 5 mm, suberect; **NSc** subquadrate-spatulate, flat or slightly emarginate, thick, bright red; **Sty** rather long; **Fr** subdivergent, pubescent; **Se** small, ovoid, reticulate. – *Cytology*: 2n = 38.

Close to *S. semiteres* and successfully hybridized with *S. alamosanum* (Uhl 1985).

S. lungtsuanense S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 115-116, 1965). **T**: China, Zhejiang (*Tsoong* 545 [PE]). – **D**: China (Fujian, SW Zhejiang).

[1] Annual herbs, stems pilose, dichotomously branched; **L** alternate, spatulate, acute, tapering towards the obtuse base, pilose, 7 - 9 × 2.2 - 3 mm; **Inf** cymes with monochasial **Br**; **Bra** like the basal **L**, tip pilose; **Ped** shorter than the **Pet**; **Fl** 5-merous; **Sep** basally free, shortly spurred, spatulate, acute, pilose, ± 2 × to 1 mm; **Pet** basally free, narrowly lanceolate, mucronate, slightly narrowed to the base, 4.5 - 5 mm; **NSc** small, square-spatulate; **Fr** glabrous, erect.

Close to *S. giajai*, but differing by the spatulate leaves and sepals.

S. ×luteolum Chaboisseau (Bull. Soc. Bot. France 10: 296, 1863). **T**: France, Vienne (*Anonymus* s.n. [not located]). – **D**: W France.

≡ *Petrosedum* × *luteolum* (Chaboisseau) Grulich (1984).

[1] = *S. rupestre* × *S. sediforme*. Intermediate between the parents: **L** terete to semiterete; **Bra** absent or only subtending the **Fl** in the centre of the **Inf**, often rudimentary; **Pet** pale yellow, 7 - 8 mm, spreading; **Fil** pale yellow, basally papillate.

S. ×luteolum nssp. **hegnaueri** ('t Hart) 't Hart (*Sedum* Soc. Newslett. No. 28: 19, 1994). **T**: France, Hautes Alpes ('t Hart 22581 [U]). – **D**: France (Hautes Alpes); only known from the French Alps.

≡ *Sedum* × *hegnaueri* 't Hart (1979).

[1] = *S. rupestre* ssp. *erectum* × *S. sediforme*. **L** linear to oblong, terete to semiterete; **Inf** globose and erect in bud; **Bra** only subtending the **Fl** in the centre of the **Inf**; **Sep** (2-) 3 (-4) mm; **Fil** basally densely papillate. – *Cytology*: 2n = 80, 96.

S. ×luteolum nssp. **luteolum** – **D**: W France (French Pyrenees, probably also in the French Alps).

[1] = *S. rupestre* ssp. *rupestre* × *S. sediforme*. **L** linear, terete; **Inf** ± drooping in bud; **Sep** 2.5 - 3 mm; **Fil** basally papillate. – *Cytology*: 2n = 88.

S. luteoviride R. T. Clausen (CSJA 18: 74-77, ill., 1946). **T**: Mexico (*Clausen* 5764c [CU]). – **D**: Mexico (probably Sierra Madre del Sur).

[1] Perennial subshrubs; stems branched, procumbent with erect tips, to 32 cm long, smooth, green, sometimes pinkish or brownish; **L** irregularly spaced along the stem axis, alternate, spreading, oblong-elliptic or subspatulate, 4 - 16 × 3 - 6 mm, shortly spurred; **Inf** terminal cymes, 7- to 30-flowered; **Fl** sessile or subsessile, 5-merous, 10 - 12 mm Ø; **Sep** 1.8 - 2.7 mm, yellowish-green; **Pet** yellow, 4 - 6 mm, stellately spreading; **NSc** transversally oblong; **Ca** greenish-yellow, 3 - 4 mm, diverging; **Se** subovoid, glabrous.

Compared with *S. confusum* in the protologue. – [H. 't Hart, B. Bleij & U. Egli]

S. lutzii Hamet (Bull. Soc. Bot. France 59: 762-764, 1913). **T**: China, Sichuan (*Soulié* 2339 [P, B]). – **D**: China (W Sichuan); grasslands, mountain ridges, shady places, rocks, trailsides, 4200 - 4400 m.

[1] Annual herbs with ascending stems, branched from the base, 3.5 - 5 cm tall; **L** alternate, broadly linear to oblong, obtuse, spurred, 5 - 6 mm; **Inf** few-flowered; **Fl** 5-merous, shortly pedicellate; **Sep** broadly sessile, triangular to semi-oblong, subobtusate, 3 - 4 mm; **Pet** oblong to ovate, submucronate, white or yellowish, 3 - 4.5 mm; **NSc** small, broadly linear-spatulate, slightly emarginate; **Fr** erect; **Se** reticulate-papillose.

S. lutzii var. **lutzii** – **D**: China (W Sichuan); ± 4400 m. **I**: Fröderström (1931: 72, t. 36); Fu & Fu (1984: t. 23).

[1] **Sep** green; **Pet** shorter than in var. *viridiflora*.

vum; epipetalous **St** inserted ± 1 mm up on the **Pet**; **Fr** few-seeded.

S. lutzii var. **viridiflavum** K. T. Fu (Acta Phytotax. Sin. 12(1): 60, t. 11: 17-24, 1974). **T**: China, Sichuan (*Fu* 16582 [WUK]). – **D**: China (W Sichuan); 4200 - 4300 m.

[1] Differs from var. *lutzii*: **Sep** greenish-yellow; **Pet** longer than in var. *lutzii*; **Fil** 2.2 - 2.5 mm, inserted higher up on the **Pet**; **Fr** many-seeded.

S. lyidium Boissier (Diagn. Pl. Orient. 1(3): 17, 1843). – **D**: W Turkey; damp mossy places on mountains. **I**: Praeger (1921a: 189).

Perennial herbs, glabrous, ascending, 5 - 10 cm tall, with creeping and rooting **Br** and perennating sterile **Ros**; **L** alternate, imbricate, linear, terete, ± 6 mm, obtuse, sessile, green, red-tipped; **Inf** dense corymbs 1 - 2 cm $\varnothing$ with (7-) 10 - 20 **Fl**; **Fl** 5-merous, pedicellate; **Sep** ± 2 mm, acute; **Pet** ± 3 mm, white with red mid-vein; **Ca** glabrous, erect.

Jalas & al. (1999: 99) report this species as being naturalized in S Sweden. – [U. Eggli]

S. macdonaldii G. L. Nesom (Phytologia 79(4): 266, 1996). **T**: Mexico, Nuevo León (*McDonald* 2135 [TEX, MEXU, BH]). – **Lit**: Nesom & Turner (1996). **D**: Mexico (Coahuila, Nuevo León); sub-alpine and alpine zones, 2850 - 3600 m.

[1] Erect perennial herbs with fibrous **R**, 4 - 7 cm tall; stems mostly hidden by the **L**, surface with low papillae and square cells in lines; **L** semiterete, flat above with a median groove, both faces minutely striate-papillate with clearly visible cellular structure; flowering **Br** as in *S. parvum*; **Pet** yellow, erect, 6 - 7 mm.

Another member of the *S. parvum* group (Nesom & Turner 1996) and compared with *S. catorce* and *S. papillicaulum* in the protologue, and most closely related to the latter. – [U. Eggli]

S. macdougallii Moran (CSJA 49(1): 39-41, ill., 1977). **T**: Mexico, Oaxaca (*MacDougall* B.278 [SD 94809]). – **D**: Mexico (Oaxaca); dry slopes, ± 1500 m. **Fig. XXXVII.a**

[1] Glabrous perennial subshrubs with erect to ascending somewhat branched stems, to 50 cm tall; **L** alternate, crowded, cuneate-obovate, thick, obtuse, subterete to nearly flat, bluish-glaucous, 13 - 36 $\times$ 9 - 21 mm; flowering **Br** axillary, red, glaucous, 5 - 12 cm; **Inf** cymes with 3 - 10 ascending, simple or bifurcate **Br**; **Bra** similar to the **L** on flowering **Br** but slightly narrower; **Ped** ± 1 mm; **Fl** 5-merous; **Sep** nearly free to the base, unequal, obovate, obtuse to rounded, glaucous, 1 - 2.5 $\times$ ± 1.5 mm, spreading; **Pet** basally free, imbricate in bud, elliptic-ovate, obtuse, slightly carinate, shortly cucullate, slightly papillose along the dorsal keel, light yellow to greenish, ± 3 mm; **Fil** greenish-yellow; **Anth** yellow; **Nsc** subquadrate, red; **Fr**

with lips along the ventral suture, reddish. – *Cytology*: 2n = 68.

S. madreense S. Watson (Proc. Amer. Acad. Arts 23: 273, 1888). **T**: Mexico, Chihuahua (*Pringle* 1241 [NY, SJ]). – **D**: Mexico (Chihuahua); dry ledges, 2600 - 3000 m. **I**: Fröderström (1936a: 102, t. 66).

[1] Perennial herbs with a somewhat creeping **R**-stock and stout branched ascending stems 10 - 15 cm tall; **L** alternate, linear or oblanceolate, obtuse, broadly spurred, mamillate, 6 - 10 mm; **Inf** broad, corymbose; **Bra** oblanceolate, 3.5 - 6 mm; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, slightly unequal, triangular-lanceolate to oblong, obtuse, 4 - 6 mm, suberect; **Pet** basally free, oblong, broadly mucronate, purple, 6 - 7 mm, suberect; **Nsc** broader than long, slightly spatulate, emarginate, thick; **Se** ovoid, reticulate-papillose. – *Cytology*: 2n = ± 128 .

S. magae Hamet (RSN 13: 349-351, 1914). **T**: India, Kumaon (*Duthie* 2920 [BSD / DD ?, K [iso]]). – **D**: NE India (Kumaon, Garhwal); 4300 - 4600 m.

Incl. *Sedum tillaeoides* Duthie ex Sandwith (1926) (*nom. illeg.*, Art. 52.1).

[?] Annual or biennial branched herbs 3.5 - 4.5 cm tall; **L** subovate, 3 - 5 mm; **Ped** short; **Fl** 5-merous or rarely 4-merous, with 4 or 5 **St**; **Sep** basally free, shortly spurred, broadly oblanceolate to narrowly obovate-sublanceolate, acute or subacute, ± 3.5 mm; **Pet** slightly connate at the base, ovate, subacute, narrowing towards the base, ± 2 mm; **Nsc** narrowly linear, obtuse; **Sty** short; **Fr** few-seeded; **Se** reticulate-papillose.

S. magellense Tenore (Fl. Napol. Prodr., 26, 4: t. 246, t. 139: fig. 1, 1811). **T**: Italy (*Tenore* s.n. [NAP]). – **Lit**: Jalas & al. (1999: 121). **D**: SE Europe (C Italy, Balkans, Greece incl. Crete), Turkey (SW Anatolia); mountains.

$\equiv$ *Oreosedum magellense* (Tenore) Grulich (1984); **incl.** *Sedum olympicum* Boissier (1843) $\equiv$ *Sedum magellense* var. *olympicum* (Boissier) Fröderström (1932) $\equiv$ *Sedum magellense* ssp. *olympicum* (Boissier) Greuter & Burdet (1986); **incl.** *Sedum brutium* N. Terracciano (1891).

[1] Perennial herbs with erect or ascending rooting stems, often forming small tufts, to 5 cm tall; **L** opposite or alternate, obovate-oblong or somewhat spatulate, sessile or semipedicellate, obtuse or rounded, flat, spreading, 6 - 10 $\times$ 4 - 8 (-10) mm; flowering **Br** erect, 5 - 15 (rarely to 30) cm, with alternate **L**; **Inf** narrow elongate racemes consisting of a variable number of small, usually few-flowered, rarely forked cincinni; **Bra** small, lanceolate; **Ped** thin, 2 - 5 mm, sometimes sparsely glandular-pubescent; **Fl** 5-merous, sometimes sparsely glandular-pubescent; **Sep** broadly sessile, basally connate, triangular-oblong, obtuse, ± 1.5 mm; **Pet** basally free, lanceolate, acute, white, ± 4 mm; **Fil**

white; **Anth** red; **NSc** spatulate, yellowish; **Sty** distinct, short; **Fr** erect, whitish; **Se** oblong, pale brown, costate. – *Cytology*: $2n = 28, 30$.

Plants from the Balkan Peninsula differ from the typical C Italian form in their smaller, broader and more constantly opposite leaves, and have been distinguished either as var. or ssp. *olympicum*.

S. magniflorum K. T. Fu (Acta Phytotax. Sin. 12(1): 61-62, t. 11: 25-33, 1974). **T**: China, Yunnan (*Chung-tien Exped.* 1396 [KUN]). – **D**: China (NW Yunnan); rocks in forests, pebble beaches, ± 3800 m. **I**: Fu & Fu (1984: t. 24).

[1] Sparsely leafy annual herbs with simple or branched dark green stems 7 - 8 cm tall; **L** alternate, narrowly oblong, obtuse, truncately spurred, 6 - 8 $\times$ 1.6 - 1.8 mm; **Inf** lax few-flowered cymes or corymbs; **Bra** L-like, 4 - 4.5 mm; **Ped** slender, 2 - 7 (-15) mm; **Fl** 5-merous; **Sep** basally free, obtusely spurred, narrowly oblong, obtuse, 6.8 - 7.5 $\times$ ± 2 mm; **Pet** basally connate for up to 0.8 mm, oblong, obtuse, yellow, 7 - 8 mm; **Fil** yellow; **Anth** dark green when dry; **NSc** linear-subspatulate, nearly rounded to truncate; **Fr** erect to suberect; **Se** obovate-lanceolate, probably reticulate.

S. maireanum Sennen (in Sennen & Mauricio, Cat. Fl. Rif Orient. 43, 1933). – **D**: Spain, Portugal, Morocco; temporarily wet places and seepages in mountain pastures, to 1900 m. **I**: Castroviejo (1997: 151, pl. 41: a-d).

Incl. *Sedum villosum* var. *ramosum* Pérez Lara (s.a.); **incl.** *Sedum villosum* var. *aristatum* Emberger & Maire (1927) $\equiv$ *Sedum villosum* ssp. *aristatum* (Emberger & Maire) Laínz (1967) $\equiv$ *Oreosedum villosum* ssp. *aristatum* (Emberger & Maire) Velayos (1989); **incl.** *Sedum paui* Sennen (1933).

[1] Annual (rarely perennial) glandular herbs, greenish or reddish; **R** fibrous; stems 5 - 13 cm, erect, rarely with sterile **Br** at the base; **L** alternate, linear, terete, 8 (-10) $\times$ 1 - 2 mm, basally spurred, obtuse, glandular-hairy; **Inf** corymbose, embracing at least $\frac{1}{2}$ of the length of flowering **Br**; **Fl** 5-merous; **Ped** (2-) 2.5 - 5 (-6) mm; **Sep** basally connate, 1 - 1.8 $\times$ 0.5 - 0.8 mm, narrowly lanceolate, obtuse, glandular; **Pet** stellately spreading, basally fused to form a tube 0.5 mm long, elliptic, 3 - 5.5 $\times$ 1 - 2 mm, acute, whitish to whitish-rose; **Ca** erect, greenish-purple, gradually tapering to the tip; **Se** 0.5 mm, striate.

Another member of Ser. *Subrosea* 't Hart and often confused with *S. lagascae* and *S. villosum*. It differs from the latter by smaller acute and sometimes apiculate petals and carpels that narrow gradually towards the style. – [U. Eggli]

S. major (Hemsley) Migo (J. Shanghai Sci. Inst. 14: 293, 1944). **T**: China, Hubei (*Henry* s.n. [K]). – **D**: W Himalaya (Bhutan, Nepal, Sikkim) to C China (Sichuan, Hubei); rocks on forested slopes,

1000 - 4300 m. **I**: Fröderström (1931: t. 19, as *S. filipes* var.); Fu & Fu (1984: t. 19).

$\equiv$ *Sedum filipes* var. *major* Hemsley (1887).

[1] Annual or biennial herbs with erect or ascending simple stems, 10 - 30 cm; **L** opposite or in whorls of 3 or 4, ovate to orbicular, petiolate, to 10 cm; **Inf** lax broad corymbs, often with long pedunculate secondary cymes from the upper **L** axils; **Ped** 2 - 3 $\times$ as long as the **Fl**; **Fl** 5-merous; **Sep** broadly sessile, triangular or semi-oblong, obtuse to rounded, 1 - 1.5 mm; **Pet** basally connate, broadly semi-oblong, subobtuse, white or reddish, 3 - 5 mm; **NSc** broadly linear-spatulate; **Fr** suberect, many-seeded; **Se** smooth (reticulate?).

S. major is close to *S. filipes* but differs by the much larger leaves, stouter stems, and larger inflorescences. Fröderström (1931) retained it as a variety of *S. filipes*, but mentioned that it could well be a distinct species.

S. makinoi Maximowicz (Bull. Acad. Imp. Sci. Saint-Petersbourg 32: 487, 1883). – **D**: China (Anhui, Zhejiang), Japan (Honshu, Shikoku, Kyushu); rocks in mountains, and on stone walls. **I**: Fröderström (1931: 96, as *S. alfredii* var.); CSJA 72(4): 201, 2000.

$\equiv$ *Sedum alfredii* var. *makinoi* (Maximowicz) Fröderström (1931); **incl.** *Sedum subtile* var. *obovatum* Franchet & Savatier (1878) $\equiv$ *Sedum obovatum* (Franchet & Savatier) Makino (1914); **incl.** *Sedum makinoi* fa. *albomarginatum* Sugimoto (1958); **incl.** *Sedum makinoi* fa. *albovariegatum* Sugimoto (1958).

[1] Perennial herbs with slender creeping stems; **L** opposite, rarely in whorls, alternate higher up on the stem, spatulate to obovate, flat, fleshy, 7 - 15 $\times$ 3 - 8 (-10) mm; flowering **Br** ascending, to 20 cm; **Inf** large much-branched lax cymes; **Bra** whorled, L-like; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, unequal, linear-spatulate, obtuse to rounded, 1 - 2 mm; **Pet** subulate to subulate-lanceolate, broadly submucronate, yellowish, 5 - 6 mm; **NSc** rectangular-spatulate; **Fr** slender, $\pm$ spreading, basally connate; **Se** probably reticulate-papillose. – *Cytology*: $2n = 64 - 72, 70, \pm 70 - 72, 72$.

Fröderström (1931) included *S. makinoi* in *S. alfredii* (as var. *makinoi*). However, it differs from *S. alfredii* by its spurred sepals and is therefore accepted as a different species by most authors. Makino (1914) regarded it as a synonym of *S. obovatum*.

The taxon was also repeatedly reported from China, but no relevant specimens have been seen by Ohba (2001: 23).

S. maurum Humbert & Maire (Mém. Soc. Sci. Nat. Maroc 15: 33, 1927). **T**: Morocco (*Humbert & Maire* s.n.). – **D**: Morocco (endemic to the Atlas Mts.). **I**: Maire (1977: 381).

[1] Densely glandular-pubescent annual herbs to

12 cm tall; **L** alternate, semiterete, sessile, rounded, 4 - 12 × 1.5 - 3.5 mm; **Ped** filiform, 2 - 3 mm; **Fl** (5- to) 6- (to 7-) merous; **Sep** broadly sessile, ovate, glandular-pubescent, 1 - 1.5 mm; **Pet** white, sometimes pinkish, outside glandular pubescent, 4 - 5 mm; **NSc** small, spatulate; **Fr** erect, papillate and glandular-pubescent, 2- or 3-seeded; **Se** costate.

Most probably merely representing a somewhat smaller and stouter, very pubescent form of *S. caeruleum*. With respect to the cytological variation within the latter species, however, further biosystematic studies in this complex are needed to assess the systematic position of the taxa involved.

S. melanatherum De Candolle (PSRV 3: 410, 1828). **T**: Spain (*Anonymus* s.n. [G-DC]). – **Lit**: Jalas & al. (1999: 86). **D**: S Spain (Sierra Nevada), Morocco (Great Atlas); wet places, 2000 - 3600 m.

≡ *Sedum album* var. *melanatherum* (De Candolle) Fröderström (1932) ≡ *Sedum anglicum* ssp. *melanatherum* (De Candolle) Maire (1932) ≡ *Sedum album* ssp. *melanatherum* (De Candolle) J. A. Huber (1936); **incl.** *Sedum rivulare* Boissier (1838) ≡ *Sedum anglicum* var. *rivulare* (Boissier) Boissier (1840).

[1] Small perennial herbs usually with long and slender stems, these trailing and rooting, branching, often forming dense mats; **L** alternate, densely imbricate, narrowly oblong, sessile with a small spur, obtuse, semi- or subterete, pale glaucous-green, ± 5 × 1.5 mm; flowering **Br** 4 - 12 cm tall; **Inf** few-flowered cymes with (1-) 2 (-3) cincinni; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile or subsessile; **Sep** basally free, spurred, oblong, 2 - 2.5 mm; **Pet** slightly connate at the base, lanceolate, white or pinkish, often with a reddish keel, ± 4 mm; **Fil** white; **Anth** dark red; **NSc** oblong or cuneate, red; **Sty** white or pink; **Fr** erect, pale brown; **Se** ovoid, reticulate-papillose. – *Cytology*: 2n = 26.

Until recently, many authors such as Webb & al. (1993) regarded *S. melanatherum* as a subspecies or variety of *S. anglicum*. It differs, however, both cytologically as well as phytochemically (Stevens 1995), and the two species are reproductively isolated. *S. melanatherum* is the type of the monotypic Ser. *Melananthera* 't Hart ('t Hart 1991). – [H. 't Hart]

S. mellitulum Rose (CUSNH 13(9): 299, t. 57, 1911). **T**: Mexico, Chihuahua (*Jones* s.n. [US 617435]). – **D**: Mexico (Chihuahua). **I**: Fröderström (1936a: 44, t. 27). **Fig.** XXXVII.c

[1] Tufted glabrous perennial herbs with a short **Rstock** and slightly roughened stems, much branched at the base, 5 - 10 cm tall; **L** alternate, linear to oblong, obtuse, terete, 3 - 8 mm, bright green, spreading; flowering **Br** erect or decumbent; **Inf** open spreading few-flowered cymes; **Ped** 2 - 3 mm; **Fl** 5- (to 6-) merous; **Sep** broadly sessile, nearly free to the base, unequal, lanceolate to oblong, ob-

tuse, 2.5 - 4 mm; **Pet** free or nearly free to the base, suboblong, acute, broadly and shortly mucronate, white, 4 - 5 mm, widely spreading; **Fil** white; **Anth** brownish; **NSc** broader than long, slightly emarginate; **Sty** rather long; **Fr** suberect; **Se** ovoid, reticulate. – *Cytology*: 2n = 36, 38, 100 ± 1, 132 ± 2, 160 - 168, ± 168, 190.

S. mexicanum Britton (Bull. New York Bot. Gard. 1: 257, 1899). **T**: Mexico, México D.F. (*Anonymus* s.n. [NY ?]). – **D**: USA (Florida), Mexico, C America, Colombia; naturalized in Taiwan, Japan and probably also in Europe (France, Spain). **I**: Fröderström (1936a: 101, t. 65); Clausen (1959: 309).

[1] Perennial herbs with decumbent stems; **L** in whorls of 4, linear or linear-lanceolate, spurred, subterete, 9 - 17 × 1.9 - 3 mm; flowering **Br** 8.5 - 30 cm; **Inf** cymes with ± 3 **Br**; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, unequal, lanceolate, acute, spurred, 3.3 - 4.7 × 0.9 - 1.6 mm; **Pet** elliptic, acute, golden-yellow, 3.3 - 4.8 × 1.3 - 1.8 mm; **Anth** yellow; **NSc** obovate- to spatulate-subquadrate, rounded, emarginate, thick, pale yellow; **Se** ellipsoid, finely papillose, dark brown. – *Cytology*: 2n = 36.

The natural range of this taxon is still unknown and it has been suggested that it might be a cultivar of probably Asian origin. The range given above is based on cultivated and naturalized material. Tang & Huang (1989: 168) treat *S. obtuso-lineare* Hayata (here included in the synonymy of *S. lineare*) as a synonym of *S. mexicanum*.

S. meyeri-johannis Engler (Hochgebirgsfl. Afrika, 229, 1892). **T**: Tanzania (*Meyer* 252 [B †]). – **D**: Kenya, Tanzania, Uganda (Kilimanjaro region); epiphyte in upland forest, or terrestrial heathland herb, 1800 - 4350 m.

Incl. *Sedum volkensii* Engler (1895); **incl.** *Sedum meyeri-johannis* var. *keniae* Fröderström (1929); **incl.** *Sedum schwendenerianum* Volkens in sched. ex Hamet (1929) (*nom. inval.*, Art. 34.1c).

[1] Glaucous or pruinose glabrous perennial herbs with decumbent or trailing branched stems to 1 m, distinctly woody at the base, often rooting at the nodes; **L** alternate or sometimes in whorls of 3, sessile, oblong-spatulate to oblong-lanceolate, to 25 × ± 8 mm, shortly spurred, obtuse, flat, dark green; **Inf** cymose or corymbose, with 3 - 4 cincinni, these sometimes forked; **Bra** 2 per **Fl**, to ± 5 mm; **Ped** 2 - 6 (-18) mm; **Fl** 5-merous; **Sep** basally free, spurred, oblong-ovate to oblong-lanceolate, 2.5 - 5 mm, obtuse; **Pet** basally slightly connate, lanceolate to oblong, 4.5 - 7 × 2 - 2.4 mm, golden-yellow; **Fil** yellow; **Anth** ± 0.7 mm, yellow; **NSc** linear-spatulate, emarginate; **Sty** ± 1 mm, recurved; **Fr** erect, pale brown; **Se** oblong-ovoid, brown, reticulate or reticulate-papillose.

Closely related to *S. ruwenzoriense*. – [H. 't Hart]

S. meyranianum J. Metzger & Acevedo Rosas (CSJA 71(6): 316-317, 1999). **T:** Mexico, Jalisco (Metzger 7001.1 [IBUG, BASBG, Herb. Metzger]). – **D:** Mexico (Jalisco); on rocks in horizontal clefts, 1600 m.

[1] Biennial herbs; seedlings developing a small corm with a tuft of **L** in the first year; **L** long obovate, basally tapering and petiole-like, 18 - 20 × 3 mm; flowering **Br** developing terminally in the second year, to 12 cm, decumbent, branched from the base, **L**-less in the upper ½; **Inf** scorpioid cymes supported by fleshy dark red **Bra**; **Fl** 5-merous; **Sep** basally connate for 1 mm, 4 - 6 mm, unequal in length; **Pet** shorter than the **Sep**, basally slightly united, narrowly lanceolate, semi-erect with mucronate recurved tips, white with pale greyish-green midvein; **Ca** erect, white to greenish-white, much swollen.

Compared with *S. jaliscanum* in the protologue. – [U. Eggli]

S. microcarpum (Smith) Schönland (in Engler & Prantl (eds.), Nat. Pfl.-fam. [ed. 1], 3(2a): 31, 1890). **T:** Cyprus (*Sibthorp* s.n. [OXF]). – **D:** Cyprus, Turkey (S and E Anatolia), W Syria; rocky limestone hills, in vernal pools, hollows and crevices flooded by winter rains, 100 - 600 m.

≡ *Crassula microcarpa* Smith (1806) ≡ *Telmissa microcarpa* (Smith) Boissier (1872); **incl.** *Telmissa sedoides* Fenzl (1842).

[?] Minute annual herbs, glabrous, erect; stems usually unbranched, 5 - 12 cm tall; **L** alternate, linear, semiterete, 4 - 10 mm, sessile; **Inf** lax cymes with 2 - 4 **Br** with 8 - 20 **Fl** each; **Fl** 3- to 5-merous, sessile; **Sep** ± 0.5 mm, obtuse; **Pet** pinkish-white, ± 1 mm; **Ca** 1 - 1.5 mm, angular-prismatic, tuberculate, punctate, completely free, with a single ovule.

Said to be rare, but perhaps simply difficult to locate due to its minute size. The monotypic genus *Telmissa* allegedly differs from *Sedum* by 1-seeded carpels, but this is not regarded as sufficient to keep it distinct. – [U. Eggli]

S. microsepalum Hayata (Icon. Pl. Formos. 3: 111, 1913). **T:** Taiwan, Nantou (*Kawakami & Mori* 2019 [TI [not found 1992], TAIF]). – **D:** Taiwan (Taipéh, Nantou, Taitung, Hualien); mountains, 1700 - 3000 m. **I:** Tang & Huang (1989: 170); Tang & Huang (1993: 27).

Incl. *Sedum truncatistigmum* Liu & Chung (1977); **incl.** *Sedum triangulosepalum* Liu & Chung (1977) (*nom. inval.*, Art. 37.1).

[1] Perennial or annual herbs with decumbent, then ascending stems, laxly branched above, 10 - 20 cm long; **L** alternate, oblong, oblanceolate or spatulate, obtuse, cuneate at the base, 20 - 25 × 5 mm; **Inf** lax cymes with ± 2 cincinni; **Fl** 5-merous, sessile; **Sep** broadly sessile, slightly unequal, triangular, acute, ± 1.5 × 0.5 mm; **Pet** linear-lanceolate,

acuminate, yellow, ± 6 mm; **Anth** yellow; **NSc** re-tuse; **Fr** coriaceous.

Fu & Fu (1984: 155) gave *S. parvisepalum* as a synonym, but regarded *S. triangulosepalum* and *S. truncatistigmum* as distinct species.

S. microstachyum (Kotschy) Boissier (Fl. Orient. 2: 787, 1872). **T:** Cyprus (*Kotschy* 786 [W]). – **Lit:** Stephenson (1993: with ill.). **D:** Cyprus (Troodos Mts.); crevices of igneous rocks, 1500 - 1900 m. ≡ *Umbilicus microstachyus* Kotschy (1865).

[1] Monocarpic herbs, erect, (9-) 25 - 40 cm with basal flat generally solitary lax **Ros**; **L** shrivelling soon after anthesis, flat, linear-spatulate, 30 - 60 × 5 - 12 mm, subacute or obtuse, green in the shade, reddish in the sun, weakly glandular-pubescent, margins entire, narrowly scarious, stem **L** numerous, shorter than those of the **Ros** but broader, densely glandular-pubescent, not obviously diminishing in size from bottom to top and continuing as **Bra** into the lower **Inf** parts; **Inf** narrow usually unbranched cylindrical panicles, 6 - 13 (-25) cm, axis densely glandular; **Fl** very numerous, crowded, 5-merous; **Ped** slender, glandular, 4 - 5 mm; **Sep** free almost to the base, narrowly ovate-deltoid, glandular, ± 3 × 1.3 mm; **Pet** narrowly ovate-acuminate, ± 5 × 1.5 mm, reddish or greenish; **NSc** not described; **Ca** erect, narrowly ovoid, thinly glandular, ± 2.5 mm, tapering into the slender ± 1 mm long **Sty**; **Fr** erect, ± 5 mm; **Se** medium brown with numerous longitudinal closely set ribs.

Related to *S. cepaea* and very close to *S. lam-pusae* and *S. cyprium*. – [U. Eggli]

S. millspaughii Hamet (Publ. Field Columbian Mus., Bot. ser. 2: 378, 1913). **T:** Guatemala, Dept. Amatitlán (*Kellerman* 6559 [F 220889]). – **D:** Guatemala; ± 1200 m.

[1] Glabrous perennial subshrubs with few-branched suberect slender stems; **L** alternate, obovate, (sub-) acute, flat, ± 25 mm; flowering **Br** erect, stout, 11 - 13 cm; **Inf** lax corymbs; **Fl** 5-merous, subsessile; **Sep** broadly sessile, suboblong, (sub-) acute, nearly as long as the **Pet**; **Pet** basally slightly connate, obovate, aristate, acute, 5 - 7 mm; **NSc** erect; **Sty** long. – *Cytology*: 2n = 48.

S. minimum Rose (Bull. New York Bot. Gard. 3(9): 40, 1903). **T:** Mexico, México (*Pringle* 4240 [US 48385]). – **D:** Mexico (México).

[1] Glabrous biennial herbs with corms, **L**-less main stems and prostrate divergent **Br**; **L** alternate, clavate, oblanceolate, oblanceolate-elliptic or elliptic-oblong, shortly spurred, subterete, 3.9 - 15.4 × 1.7 - 4 mm; flowering **Br** erect, often secondarily branched; **Inf** compact few-flowered cymes; **Ped** 0.6 - 4.4 mm, white; **Fl** (4- to) 5- (to 7-) merous; **Sep** basally free, broadly spurred, unequal, oblanceolate-oblong, obtuse, 2.4 - 8.9 × 0.7 - 2.6 mm, erect; **Pet** basally free, lanceolate-oblong or elliptic-

oblong, obtuse, hooded, white or creamy-white, streaked with red, ± 5 mm, suberect; **Anth** dark red, rarely creamy white; **NSc** oblong, truncate, emarginate, dark red with yellow base; **Fr** widely divergent, pale brown; **Se** oblong or pear-shaped, dark brown, often curved, reticulate or reticulate-papillose. – *Cytology*: $2n = 20, 22$.

S. minimum ssp. **delicatum** (Rose) R. T. Clausen (Sedum Trans-Mex. Volcanic Belt, 302, 1959). **T**: Mexico, México (*Purpus* s.n. [US 474951]). – **D**: C Mexico (México: Mt. Iztaccihuatl); 3700 – 4230 m.

≡ *Sedum delicatum* Rose (1911).

[1] Differs from ssp. *minimum*: **Sep** usually longer than the **Pet**; **Pet** connate for ± 0.4 mm.

S. minimum ssp. **minimum** – **D**: C Mexico (México: Nevado de Toluca); black volcanic ash and pumice, 3900 – 4100 m.

Incl. *Sedum pringlei* var. *minus* Robinson & Seaton (1893).

[1] **Sep** usually shorter than or about as long as the **Pet**; **Pet** connate for ± 0.2 mm.

S. mocinianum Pérez-Calix (Acta Bot. Mex. 45: 50–51, ill., 1998). **T**: Mexico, Guanajuato (*Pérez-Calix & al.* 3797 [IEB]). – **D**: Mexico (Guanajuato); local, on igneous rock walls, 2400 m.

[1] Perennial herbs; stems to 80 cm and pendent, to 5 mm $\varnothing$, branched, **Br** first appearing as sessile **Ros**, rarely all stems short and plants therefore cushion-like, all parts except interior of **Fl** densely pubescent with hyaline **Ha** to 0.5 mm; **L** in dense **Ros** or spirally along upper stem parts, elliptic to oblong-elliptic, $8 - 25 \times 6 - 11$ mm, ± 5 mm thick, obtuse; **Inf** thyrsoïd with up to 10 cincinnoid **Br** with 1 – 3 **Fl**; **Bra** like rosette **L** but slightly shorter; **Fl** sessile or subsessile, 5-merous; **Sep** basally fused for 1 mm, lobes almost equal, $2.5 - 3 \times 1.5 - 2$ mm; **Pet** free, oblong-lanceolate, 5×3 mm, white; **NSc** narrowly oblong or ovate, ± 0.4 mm, **Ca** 5 mm, basally with a concavity, pale green.

Closely related to *S. hintonii*. – [U. Eggli]

S. modestum Ball (J. Bot. 11: 333, 1873). – **D**: Morocco (Middle and High Atlas Mts.); on limestone. **I**: Sedum Soc. Newslett. 34: 22–24; 35: 8–10, 1995.

≡ *Oreosedum modestum* (Ball) Grulich (1984).

[2] Small short-lived annual herbs with stems to 10 (–20) cm tall, glandular-pubescent throughout, esp. in the upper parts; **L** alternate, flat, succulent, spatulate to petiolate with an obovate to oblong-obovate lamina, $10 - 20$ (–40) $\times 3 - 12$ mm, obtuse, green, lower face often reddish or purplish; **Inf** lax few- or many-flowered cymes with 2 to many cinnini; **Bra** 1 per **Fl**; **Ped** filiform, 3 – 6 mm; **Fl** (5- to 6- (to 8-) merous, almost globular in bud; **Sep** broadly sessile, basally connate, equal, oblong, 2 –

2.5 mm, acuminate; **Pet** basally connate, lanceolate to elliptic, $5 - 7 \times \pm 3$ mm, acuminate to aristate, yellow; **Fil** yellow; **Anth** yellow; **NSc** broadly square; **Sty** short; **Fr** erect, brown; **Se** ovoid, reddish-brown, costate. – *Cytology*: $2n = 16$.

Molecular studies have shown that this species is closely related to *S. jaccardianum* and *S. surculosum*, though the latter two are closer to each other than to *S. modestum* (Mes & 't Hart 1994). These 3 species have been classified as Ser. *Monanthoidea*, which is the sister-group of the "Macaronesian *Sempervivoideae*", i.e. *Aeonium*, *Aichryson* and *Monanthes* (Mes 1995a).

S. monregalense Balbis (Misc. Bot. 23, 1804). – **D**: SE France, Corsica, NW to C Italy; shaded rocks in the mountains. **I**: Praeger (1921a: 172).

≡ *Oreosedum monregalense* (Balbis) Grulich (1984); **incl.** *Sedum cruciatum* De Candolle (1815); **incl.** *Sedum luteovirens* Briquet (1913).

[1] Perennial weak herbs; stems decumbent and rooting at the nodes, to 5 cm tall, glabrous or almost so; **L** alternate, crowded, 5 – 7 mm, oblanceolate, fleshy, smooth or somewhat glandular near the tip, obtuse; flowering **Br** 10 – 15 cm tall, branched throughout or in the upper parts only, upper parts glandular-hairy, **L** in verticils of (3-) 4 (–5), similar to those of sterile stems; upper **L** hairy; **Inf** lax panicles with cymose **Br**, bracteate; **Fl** 5-merous, pedicellate, stellate, ± 9 mm $\varnothing$; **Sep** ovate, acute, hairy; **Pet** ovate, white, acute, spreading or slightly reflexed, with greenish hairy keel, $3 \times$ as long as the **Sep**; **Ca** erect, whitish.

Superficially similar to *S. alsinefolium*. – [U. Eggli]

S. montanum Sonceon & E. P. Perrier (Billotia 1: 77, 1864). **T**: France, Savoie (*Anonymus* s.n. [not located]). – **Lit**: 't Hart (1978); Jalas & al. (1999: 111). **D**: C, S, SE and SW Europe.

≡ *Sedum rupestre* ssp. *montanum* (Sonceon & E. P. Perrier) P. Fournier (1936) ≡ *Sedum ochroleucum* ssp. *montanum* (Sonceon & E. P. Perrier) D. A. Webb (1961) ≡ *Petrosedum montanum* (Sonceon & E. P. Perrier) Grulich (1984) ≡ *Petrosedum rupestre* ssp. *montanum* (Sonceon & E. P. Perrier) Velayos (1989).

[1] Glabrous perennials; sterile shoots $\pm$ procumbent, rooting; **L** imbricate, alternate, linear, mucronate, terete, basally spurred, 10 – 15 mm, green or glaucous; flowering **Br** erect or ascending, 10 – 35 cm; **Inf** terminal corymbs with 3 – 6 **Br**, densely glandular-pubescent, erect and flat-topped in bud, **Br** scarcely recurved; **Bra** L-like; **Fl** (5- to 6- (to 8-) merous, subsessile; **Sep** basally connate, triangular, long acuminate, densely glandular-pubescent; **Pet** free, oblong, 8 – 10 (–12) mm, yellow, spreading; **Fil** yellow; **Anth** yellow; **NSc** transversely oblong, greenish; **Fr** erect, brown; **Se** oblong, brown, costate.

S. montanum ssp. **montanum** – **D**: Pyrenees, Appennines, Alps (Austria, Switzerland, Italy, France), Spain.

Incl. *Sedum sulfureum* Legrand (1869).

[1] Flowering **Br** slender; **Sep** triangular, long acuminate, 5 - 7 (-10) mm; **Fil** always glabrous; **Sty** slender, strongly curved outwards during anthesis. – *Cytology*: $2n = 34, 51, 68$.

S. montanum ssp. **orientale** 't Hart (Biosyst. Stud. Gen. Sedum 106, 1978). **T**: Italia, Trieste ('t Hart s.n. [U 16685]). – **D**: E Alps (Austria, Slovenia, Switzerland, Italy).

≡ *Petrosedum orientale* ('t Hart) Grulich (1984);

incl. *Sedum xthartii* L. P. Hébert (1984).

[1] Differs from ssp. *montanum*: Whole plant more robust; **Sep** triangular-lanceolate, acuminate, 3 - 4 mm; **Fil** usually densely papillose at the base; **Sty** firm, curved outwards during anthesis. – *Cytology*: $2n = 98$.

This subspecies is allopolyploid. It evolved from a natural (sterile?) hybrid of diploid *S. montanum* ssp. *montanum* ($2n = 34$) and tetraploid *S. rupestre* ssp. *erectum* ($2n = 64$) through polyploidization. In the process the new subspecies became fully fertile. It is rather an aggressive grower and quite common in gardens in NW Europe, where it is most often confused with *S. rupestre* ssp. *rupestre* ('t Hart 1978).

S. mooneyi M. G. Gilbert (Bradleya 3: 50, ill. (p. 51), 1985). **T**: Ethiopia, Bale Region (*Mooney* 7156 [K, ETH]). – **D**: Ethiopia (Arssi and Bale Regions, endemic); on rocks in Afro-alpine moorland, 3450 - 4100 m.

[2] Glabrous dwarf shrubs with basally woody stems to 30 cm tall, but usually < 15 cm, young **Br** densely mamillate, often trailing and rooting at the nodes; **L** in whorls of 3, sessile, obovoid to elliptic, 7 - 12 × 3 - 5 mm, obtuse, flattened, shiny green or flushed with red; **Inf** few-flowered bracteate corymbs; **Ped** to 6.5 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate for 1 mm, ovate, 2 - 3.5 mm; **Pet** lanceolate, 7.5 - 9 × ± 3 mm, acuminate, bright yellow, often flushed red; **Fil** 4 - 6 mm, yellow; **Anth** globose, yellow; **NSc** square to cuneate; **Sty** 2 mm; **Fr** many-seeded, erect; **Se** oblong-ovoid, dark reddish-brown, costate.

Closely related to *S. churchillianum* and *S. epidendrum*.

S. moranense Kunth (in Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 6: 37, 44, 1823). **T**: Mexico, Hidalgo (*Bonpland* s.n. [P]). – **D**: Mexico (C Mexican Plateau, E Trans-Mexican Volcanic Belt).

[1] Perennial subshrubs with decumbent or procumbent stems, stems much-branched, spreading, becoming brown and dark red when aging, to 20 cm tall; **L** alternate, ovate or lanceolate, obtuse or truncate, sometimes papillose, shortly spurred, green,

frequently red-tipped, 2 - 6.7 × 1.2 - 2.8 mm; flowering **Br** erect or ascending; **Inf** cymes with 1 (sometimes 2) **Br**; **Fl** 5- (to 7-) merous, sessile or subsessile; **Sep** basally free, broadly spurred, unequal, ovate or lanceolate, obtuse, with scarious margins, 1.9 - 4.4 × 0.5 - 1.9 mm, suberect; **Pet** basally connate, lanceolate, acute or obtuse, mucronate, carinate, white with slightly green or reddish keel, ± 5.5 mm, suberect; **Fil** whitish; **Anth** red or purple; **NSc** obovate-subquadrate or subquadrate, truncate, subemarginate, white or pale yellow; **Fr** divergent, brown; **Se** pear-shaped or ellipsoid, brown, reticulate or reticulate-papillose. – *Cytology*: $2n = 42, 48, 76, 80, 100, 104, 108, 114, 120, 126, 144, 154, 200, 280, 306$.

S. moranense ssp. **grandiflorum** R. T. Clausen (Sedum Trans-Mex. Volcanic Belt, 272, 1959). **T**: Mexico, San Luis Potosí (*Clausen* 7451 [CU]). – **D**: Mexico (San Luis Potosí).

[1] Differs from ssp. *moranense*: **Sep** ± 3.9 × ± 1.6 mm; **Pet** ± 7.8 × ± 2.6 mm.

S. moranense ssp. **moranense** – **D**: Mexico (C Mexican Plateau, E Trans-Mexican Volcanic Belt); 2100 - 3060 m. **I**: Fröderström (1936a: 86, t. 54); Clausen (1959: 260). **Fig. XXXVII.e**

Incl. *Sedum arboreum* Masters (1878) ≡ *Sedum moranense* var. *arboreum* (Masters) Praeger (1917); **incl.** *Sedum submontanum* Rose (1903).

[1] **Sep** 2.4 - 2.6 × 0.7 - 1.2 mm; **Pet** 4.5 - 5.8 × 1.3 - 1.6 mm.

S. moranii R. T. Clausen (Bull. Torrey Bot. Club 69: 40, 1942). **T**: USA, Oregon (*Leach & Leach* 1599 [ORE]). – **D**: W USA (Oregon: canyon of the Rogue River); on serpentine, 10 - 220 m. **I**: Clausen (1975: 434).

Incl. *Cotyledon glandulifera* L. F. Henderson (1930) ≡ *Gormaniana glandulifera* (L. F. Henderson) L. F. Henderson (1941) ≡ *Sedum glanduliferum* (L. F. Henderson) M. Peck (1941) (*nom. illeg.*, Art. 53.1).

[2] Perennial herbs with branched **Rstock** with compact **Ros**; **L** alternate, oblong-spatulate, broadly rounded or obtuse, emarginate, papillose-crenulate at the tip, flat, stiff, 14 - 32 × 9 - 14 mm, green and glaucous when young, ascending; flowering **Br** 13 - 30 cm; **Inf** cymes with 3 (sometimes 2) **Br**; **Bra** oblong-spatulate, glandular-pubescent; **Ped** 1 - 3.6 mm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, ovate or lanceolate, obtuse or acute, ± 7.5 × 4 mm, glandular-pubescent, erect; **Pet** basally connate, convolute, oblong-lanceolate, aristate, glandular-pubescent, sulphur-yellow, ± 14 mm, erect; **Fil** greenish-yellow; **Anth** yellow; **NSc** narrowly reniform, white; **Fr** subdivergent, brown; **Se** oblong pear-shaped, brown, costate. – *Cytology*: $2n = 30$.

S. morganianum E. Walther (CSJA 10(3): 35-37, ill., 1938). **T**: Mexico, Veracruz (*Walther* 35/23

[CAS]). – **D**: Known from cultivation only. **Fig. XXXVII.d**

[1] Glabrous perennial herbs with long pendulous glaucous-green stems; **L** crowded, in 5 obvious spirals, oblong-lanceolate or elliptic, acute, falcate, subterete, almost orbicular, glaucous, 15 - 30 × 5 - 8 mm thick; flowering **Br** pendent; **Inf** corymbs; **Fl** 5-merous, long-pedicellate; **Sep** broadly sessile, connate, unequal, triangular-acuminate, 5 - 9 mm; **Pet** basally connate, lanceolate, acuminate, subcucullate, mucronate, red-purple, 10 - 12 mm, erect; **Fil** pink; **Anth** light yellow; **NSc** broad, emarginate, deep pink. – *Cytology*: 2n = 70.

S. morrisonense Hayata (J. Coll. Sci. Imp. Univ. Tokyo 25: 94, 1908). **T** [lecto]: Taiwan (*Nagasaza* 566 [TI]). – **D**: Taiwan; mountains above 2500 m. **I**: Tang & Huang (1989: 171); Tang & Huang (1993: 29).

Incl. *Sedum cryptomerioides* Bartlett & Yamamoto (1932).

[1] Perennial herbs with erect reddish stems, branched at the base, to 8 cm; **L** alternate or whorled, densely imbricate, oblong-lanceolate, obtuse, 6 (-15) × ± 1.5 (-3) mm; **Inf** many-flowered cymes with 2 - 4 sometimes forked cincinni; **Bra** L-like, shorter than the **Fl**; **Fl** 5-merous, sessile; **Sep** basally free, spurred, unequal, oblong-linear, obtuse, ± 3 mm; **Pet** oblong-linear to lanceolate, obtuse, yellow, ± 6.5 mm; **NSc** minute, broadly square; **Sty** ± 6 mm; **Fr** erect, membranous; **Se** oblong, reticulate-papillose.

Tang & Huang (1989) treated *S. cryptomerioides* as a distinct species, which is separated from *S. morrisonense* by its larger leaves arranged in whorls. However, phyllotaxis and leaf size appear to be rather variable in these taxa.

S. mucizonia (Ortega) Hamet (Candollea 4: 39, 1929). **T**: Spain? (*Ortega* s.n. [MA [Herb. Cavanilles]]). – **D**: SW Europe (Portugal, Spain), N Africa (Algeria, Morocco). **I**: Castroviejo (1997: 133, t. 37: f-i). **Fig. XXXVII.f**

≡ *Cotyledon mucizonia* Ortega (1772); **incl.** *Cotyledon hispida* Lamarck (1786) (*nom. illeg.*, Art. 52.1?) ≡ *Umbilicus hispidus* (Lamarck) De Candolle (1828) ≡ *Cotyledon mucizonia* var. *hispida* (Lamarck) Perez Lara (1891) ≡ *Mucizonia hispida* (Lamarck) A. Berger (1930); **incl.** *Cotyledon viscosa* Vahl (1791) (*nom. illeg.*, Art. ?); **incl.** *Cotyledon mucizonia* var. *glabra* Braun-Blanquet & Maire (1922) ≡ *Cotyledon mucizonia* subvar. *glabra* (Braun-Blanquet & Maire) Maire (1932); **incl.** *Cotyledon mucizonia* var. *eu-mucizonia* Maire (1929) (*nom. inval.*, Art. 26.1, 32.1c); **incl.** *Cotyledon mucizonia* ssp. *abylaea* Font Quer & Maire (1931) ≡ *Mucizonia hispida* ssp. *abylaea* (Font Quer & Maire) Greuter (1981) ≡ *Sedum mucizonia* ssp. *abylaeum* (Font Quer & Maire) Springate (1996); **incl.** *Cotyledon mucizonia* subvar. *glabella* Font Quer &

Maire (1931); **incl.** *Cotyledon mucizonia* subvar. *villosa* Font Quer & Maire (1931); **incl.** *Cotyledon mucizonia* ssp. *ortegae* Font Quer & Maire (1931) (*nom. inval.*, Art. ?); **incl.** *Cotyledon mucizonia* subvar. *eu-hispida* Maire (1932); **incl.** *Sedum henriquesii* A. Caballero (1949) ≡ *Mucizonia henriquesii* (A. Caballero) Velayos & al. (1990); **incl.** *Sedum mucizonia* ssp. *urceolatum* R. Stephenson (1993).

[1] Usually glandular-pubescent glaucous annual herbs with erect, often branched stems, to 15 (-20) cm tall; **L** alternate, sessile, subterete, elliptic to oblong or narrowly ovate, 7 - 18 (-20) × 2 - 5 (-8) mm, obtuse to rounded, sparsely glandular-pubescent or glabrous, glaucous-green; **Inf** lax glandular-pubescent cymes with 2 or more cincinni; **Bra** 1 per **Fl**; **Ped** 4 - 6 mm; **Fl** 5-merous; **Sep** broadly sessile, lanceolate, 1.5 - 5 mm; **Pet** basally connate forming a tube 5.5 - 10 mm long, lobes ovate, 1.5 - 4 mm, acuminate, white or pink, often with purple veins; **Fil** basally connate with the **Cl** tube, white; **Anth** red or yellow; **Sty** slender, ± 1 mm; **Fr** erect, glaucous pale brown; **Se** brown, costate. – *Cytology*: 2n = 16, 18, 20, 22.

Quite variable in size and shape of the leaves, pubescence, and flower shape and colour, but very distinct within the genus because of its sympetalous flowers. *Cotyledon mucizonia* ssp. *abylaea* (incl. the 2 subvarieties) is allegedly perennial and deserves further study. These taxa are only known from the type locality of the subspecies.

S. mucizonia is closely related to *S. dasyphyllum* and *S. wilczekianum*. It can be easily hybridized with the former, but the hybrids are completely sterile ('t Hart & al. 1999).

S. multicaule Wallich ex Lindley (Edward's Bot. Reg. 1840: Misc.: 58, 1840). **T**: K ?. – **D**: W Himalaya: Pakistan, India, Bhutan and Sikkim to Myanmar, Tibet and China; 1300 - 3500 m. **I**: Fröderström (1931: 83, t. 51); Fu & Fu (1984: t. 31).

[1] Perennial herbs with short sterile stems; **L** alternate, imbricate, broadly linear to (narrowly) oblong or ovate (rarely), acuminate, 10 - 15 × 1 - 2 mm; flowering **Br** ascending, numerous, much-branched, 7 - 15 cm; **Inf** bracteate cymes with 2 cincinni; **Fl** 5- to 7-merous; **Sep** broadly sessile, unequal, acuminate, 5 - 6.5 mm; **Pet** semi-oblong, long mucronate, yellowish, 4.5 - 6 mm, usually shorter than the **Sep**; **Fr** stellately patent with distinct lips along the sutures; **Se** reticulate-papillose.

S. multicaule ssp. **multicaule** – **D**: As for the species, China (Gansu, Shaanxi, Sichuan, Yunnan); rocks on forested slopes, rock walls, 1300 - 3500 m.

Incl. *Sedum mekongense* Praeger (1921).

[1] Stems more slender, bark basally not rugose when dry; **L** broadly linear to oblong; flowering **Br** with numerous subsidiary **Inf**; **Inf** cincinni not forked; **Sep** broadly lanceolate; **Pet** all of equal length; **NSc** rectangular, emarginate.

S. multicaule ssp. **rugosum** K. T. Fu (Acta Bot. Boreal.-Occid. Sin. 6(2): 105, ill. (p. 107), 1986). **T:** Tibet (*Quing-zang Exped.* 10846 (1982) [PE]). – **D:** SE Tibet, China (NW Yunnan); rock crevices, 2200 - 2300 m.

[1] Differs from ssp. *multicaule*: Stems thick, bark basally rugose when dry; **L** ovate, narrowly oblong in the upper stem parts; flowering **Br** without subsidiary **Inf**; **Inf** cincinni forked; **Sep** sub lanceolate to narrowly semi-oblong; **Pet** unequal in length; **NSc** transversely rectangular.

S. multiceps Cosson & Durand (Bull. Soc. Bot. France 9: 171, 1862). – **D:** N Algeria; endemic to the mountains. **I:** Stephenson (1994: pl. 46). **Fig. XXXVIII.b**

[1] Perennial herbs or subshrubs, stems succulent, much branched, erect or ascending, to 15 cm tall; **L** alternate, densely imbricate, tufted, linear to linear-oblong or lanceolate, sessile with a small trilobate spur, obtuse, subterete, papillate, 4 - 10 × 1 - 2 mm; flowering **Br** simple, erect; **Inf** corymbiform with up to 12 **Fl** on 2 - 4 rarely forked cincinni; **Bra** 2 per **Fl**; **Fl** 5- (to 7-) merous, sessile or subsessile; **Sep** broadly sessile, broadly linear to oblong, acute, ± 3 mm; **Pet** basally free, broadly ovate to oblong-lanceolate, mucronate, yellow, ± 6 mm; **Fil** yellow; **Anth** yellow; **NSc** square to oblong; **Sty** ± 1 mm; **Fr** stellately patent, dark brown with pale brown lips along the suture; **Se** ovoid, dark brown, reticulate-papillose. – *Cytology*: 2n = 58.

Closely related to *S. tuberosum* from Tunisia and W Algeria. If grown together, the 2 species hybridize spontaneously (= *S. ×battandieri*). It belongs to the comparium of *Ser. Alpestria* A. Berger ('t Hart 1991). – [H. 't Hart]

S. multiflorum R. T. Clausen (Bull. Torrey Bot. Club 105(3): 220-221, 1978). **T:** Mexico, Jalisco (*Clausen 773022* [CU, ENCB, MEXU]). – **D:** Mexico (Jalisco); ± 1700 m.

[1] Glabrous perennial ± tufted herbs with tuberous **R** and few short sterile stems, 2 - 4 cm tall, very leafy; **L** alternate, oblanceolate-linear, obtuse or rounded to truncate, papillose, 11 - 17 × ± 3 mm, ± 1 mm thick, spreading; flowering **Br** erect or ascending, papillose; **Inf** many-branched cymes; **Fl** 5-merous; **Sep** basally free, broadly spurred, nearly equal, lanceolate, obtuse; **Pet** free to the base, lanceolate, subacute to acuminate, narrowly mucronate, papillose, white; **Anth** red; **NSc** reniform, white or creamy-white; **Sty** long and slender; **Fr** erect to suberect, canaliculate, brownish-white; **Se** subovoid, reticulate. – *Cytology*: 2n = 24.

S. muscoideum Rose (Bull. New York Bot. Gard. 3(9): 39, 1903). **T:** Mexico, Oaxaca (*Conzatti & Gonzales 777* [US]). – **D:** Mexico (Oaxaca). **Fig. XXXVIII.c**

[1] Perennial herbs, stems branched, creeping; **L** alternate, obtuse, minute, thickish, closely set along the stem; **Inf** terminal with 1 or 2 **Fl**; **Fl** 5-merous, sessile; **Sep** ovate, obtuse, ± 1 mm; **Pet** lanceolate, ± 3.5 mm, yellow. – *Cytology*: 2n = 68.

Fröderström (1936a: 89) regarded *S. muscoideum* as synonym of *S. cupressoides*, but it has a different basic chromosome number (Uhl 1985).

S. muyaicum K. T. Fu (Acta Bot. Boreal.-Occid. Sin. 6(2): 107-108, ill. (p. 110), t. 2, 1986). **T:** China, Sichuan (*Hu & Zhu 11001* [WUK]). – **D:** China (W Sichuan).

[1] Minute perennial herbs; **L** alternate, oblong to obovate-oblong, obtusely acute, shortly spurred, usually somewhat narrowing at the base, ± 2 mm; flowering **Br** simple or in tufts, 1.2 - 2.3 cm; **Inf** few-flowered cymes; **Ped** 3 - 5 mm; **Fl** 5-merous; **Sep** linear-lanceolate, obtusely acute, ± 4 mm; **Pet** basally slightly connate, linear, subacute, greenish-red to yellowish-green, ± 3.5 mm; **Anth** pink; **NSc** transversely rectangular; **Sty** to 2 mm; **Fr** erect; **Se** narrowly ovate.

S. muyaicum is close to *S. celiae*. It differs from the latter by its tiny simple stems, oblong to obovate-oblong leaves, 5-merous flowers, and sepals longer than the petals.

S. nagasakianum (Hara) H. Ohba (J. Jap. Bot. 56 (6): 181-182, ill., 1981). **T:** Japan, Kyushu (*Greatrex 36/41* [TI]). – **D:** Japan (W and S Kyushu); on rocks along the coast.

≡ *Sedum alfredii* var. *nagasakianum* Hara (1947).

[1] Tufted perennial herbs; **L** alternate or opposite, ± crowded, broadly spatulate-oblong to obovate, subacute, obtuse or retuse, sometimes mamillate towards the tip, 5 - 15 mm; flowering **Br** numerous, ascending, slender, 10 - 20 cm; **Fl** 5-merous; **Sep** broadly sessile, basally connate, unequal, broadly oblanceolate to semi-oblong, subacute to retuse, 2.5 - 5 mm; **Pet** linear-lanceolate, shortly mucronate, yellowish, 6 - 7 mm; **NSc** rectangular-spatulate; **Fr** basally connate, ± spreading; **Se** reticulate-papillose. – *Cytology*: n = 62 (Uhl & Moran 1972).

Similar to *S. alfredii* from China, but with larger flowers and leaves and bracts with rounded tips.

S. nanchuanense K. T. Fu & G. Y. Rao (Acta Bot. Boreal.-Occid. Sin. 8(2): 116-117, ill. (p. 120), 1988). **T:** China, Sichuan (*Guan & al.* 1041 [WUG, CDBI]). – **D:** China (SE Sichuan); rocks on slopes, ± 1200 m.

[1] Perennial herbs with suberect stems, 3 - 5 cm; **L** alternate, oblong to obovate, rounded to obtuse, shortly spurred, 5 - 8 × 2.5 - 4 mm; flowering **Br** erect or procumbent from the base, densely leafy, 5 - 10 cm; **Inf** many-flowered cymes with 3 cincinni; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, unequal, triangular and broadly linear, ob-

tuse, $1 - 2.5 \times \pm 1$ mm; **Pet** basally slightly connate, oblong-lanceolate, mucronate, yellow, 4.5 - 6.5 mm; **Anth** yellowish-brown; **NSc** somewhat fan-shaped; **Sty** 1 - 1.5 mm; **Fr** stellately patent; **Se** reticulate-papillose.

Close to *S. uniflorum* ssp. *japonicum* but differing by its simple or little-branched stems, oblong subterete crowded leaves, basally slightly connate petals, and the shape of the nectary scales.

S. nanifolium Fröderström (Acta Horti Gothob. 10(Appendix): 96, ill., t. 61, 1936). **T:** Mexico, Coahuila (Palmer 722 [UC, GH]). – **Lit:** Nesom & Turner (1996). **D:** USA (Texas: Brewster County), Mexico (E Chihuahua, Coahuila, C Nuevo León); limestone gravel in various vegetations, (1200-) 1600 - 2300 (-2700) m.

≡ *Sedum parvum* ssp. *nanifolium* (Fröderström) R. T. Clausen (1978).

[1] Perennial herbs, stems procumbent and later erect, slender and long, branched, to 20 cm, smooth, lower parts prominently reddish-shiny; **L** densely set, alternate, orbicular to broadly obovate, thick, semiterete, $2.5 - 3.5 (-5) \times 2 - 2.5$ mm, green with prominent red dots; flowering **Br** erect, elongate; **Inf** subscorpioid cymes; **Bra** oblong, obtuse, broadly spurred, ± 3 mm; **Fl** 5-merous, sessile; **Sep** basally free, long spurred, unequal, subovate, obtuse, thick, $2 - 2.5$ mm, suberect; **Pet** basally free, lanceolate, subobtuse, narrowly mucronate, yellow with prominent short red longitudinal stripes, $4.5 - 5$ mm; **NSc** inconspicuous, $2 \times$ as broad as long, slightly emarginate; **Sty** short; **Fr** spreading; **Se** ovoid, reticulate-papillose. – *Cytology*: $2n = 52$, 53, 104.

Another member of the *S. parvum* group (Nesom & Turner 1996). – [H. 't Hart, B. Bleij & U. Eggli]

S. nanum Boissier (Diagn. Pl. Orient. 1(6): 56, 1845). **T:** Iran (*Kotschy* 623 [?, BM, K]). – **D:** Turkey (SW and E Anatolia), W Iran; damp soil, edges of marshes, 1250 - 3000 m.

≡ *Oreosedum nanum* (Boissier) Grulich (1984).

[1] Minute annuals herbs $2 - 8$ cm tall, erect, stems usually simple; **L** linear, terete, alternate, $8 - 14$ mm, glabrous, shortly spurred; **Fl** solitary in the upper **L** axils, or **Inf** corymbose, lax, with $2 - 10 (-15)$ **Fl**; **Fl** 5-merous; **Sep** $1 - 1.5$ mm, acute; **Pet** pale yellow, ± 3 mm; **Ca** glabrous, erect.

The recently described *S. caroli-henrici* and *S. yildizianum* are close allies. Another recently described species compared with this taxon is *S. elburzense*. – [U. Eggli]

S. napiferum Peyritsch (Linnaea 30: 50-51, 1859). **T:** Mexico, México (*Heller* 457 [WU]). – **D:** Mexico (Trans-Mexican Volcanic Belt), ± 2800 m. **I:** Fröderström (1936a: 122, t. 37).

[1] Biennial herbs producing an elongated white few-leaved corm, with flowering **Br** the following

year; first **L** of the corm nearly globular, ± 2 mm, upper **L** clavate, ± 9.5 mm; **L** on flowering **Br** alternate, lanceolate or ovate, obtuse, very shortly spurred, subterete, pale green, $4.3 - 7.9 \times 2 - 3.6$ mm; flowering **Br** erect; **Inf** small few-flowered corymbs; **Ped** $2 - 6$ mm, sometimes papillose; **Fl** 5-merous; **Sep** basally free, broadly spurred, unequal, ovate, obtuse, green, $2.4 - 5 \times 1.2 - 2.7$ mm, suberect; **Pet** basally free, lanceolate, bluntly appendaged at the tip, white, usually with $3 - 4 (-5)$ bands of dark red, ± 5.5 mm, suberect; **Fl** pink or dark red; **Anth** dark red; **NSc** spatulate-oblong or oblong, truncate, subemarginate, dark red, greenish or yellowish at the base; **Sty** very short; **Fr** widely divergent, with small lips along the ventral suture, brownish; **Se** pear-shaped, yellow-brown, reticulate or reticulate-papillose.

S. neovolcanicum Pérez-Calix & I. García (Acta Bot. Mex. 58: 58-60, ill., 2002). **T:** Mexico, Michoacán (*García & Hernandez* 5542 [IEB, CIMI, ENCB, MEXU]). – **D:** SW Mexico (Michoacán, Jalisco); epiphytic or lithophytic on shady moist hill-sides in conifer forests, 2650 - 3250 m.

[1] Perennial prostrate to pendent herbs to 40 cm, stems to 5 mm $\varnothing$ at the base, first green, later greyish, with adventitious **R**; **L** linear-oblongate, $(6-) 10 - 22 \times 1.5 - 3$ mm, with shortly spurred base, minutely papillose; **Fl** 5-merous, solitary or in up to 5-flowered cincinni, sessile or with a **Ped** to 2.4 mm; **Sep** unequal or almost equal, free, linear-oblong, $5 - 13 \times 2 - 3.5$ mm; **Pet** free, oblong-elliptic, $8 - 11 \times 5$ mm, white, or white with greenish or rose tinge, stellately spreading; **NSc** oblong, $0.6 - 0.8 \times 0.4$ mm, dark red; **Ca** basally fused; **Se** not described.

Compared with *S. bourgaei*, *S. multiflorum* and *S. tortuosum* in the protologue. It differs from all of these in the solitary flowers or single few-flowered cincinni, as well as sessile or shortly petiolate and larger flowers. – [U. Eggli]

S. nevadense Cosson (Notes Pl. Crit. 3(4): 163-164, 1852). **T:** Spain, Granada (*Bourgeau* 1175 [P [Herb. Cosson]]). – **D:** Spain, Morocco; dry pastures on limestone, 800 - 2200 m. **I:** Fröderström (1932: 92, pl. 50).

≡ *Sedum villosum* ssp. *nevadense* (Cosson) Bataandier (1889) ≡ *Oreosedum nevadense* (Cosson) Grulich (1984) ≡ *Oreosedum villosum* ssp. *nevadense* (Cosson) Velayos (1989); **incl.** *Sedum nevadense* var. *javallambrense* Sennen & Pau in sched. (1890) (*nom. inval.*, Art. 29.1); **incl.** *Sedum javallambrense* Pau in sched. ex Willkomm (1893) (*nom. inval.*, Art. 34.1c?); **incl.** *Sedum villosum* var. *glabrum* Cosson ex Hamet (1929) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum rivasgodayi* A. Segura (1975) ≡ *Sedum atratum* var. *rivasgodayi* (A. Segura) Fernandez Casas & A. Segura (s.a.).

[1] Annual herbs, glabrous, reddish; **R** fibrous;

stems (2-) 6 (-10) cm, erect, branched in the upper $\frac{1}{2}$; **L** alternate, oblong-linear, (3.5-) 5 - 9 $\times$ 2 mm, basally without a spur; **Inf** dense branched cymes; **Fl** 5-merous, with only 5 **St**; **Ped** 1.5 - 3 mm; **Sep** ovate, 2 $\times$ 1 mm, basally united; **Pet** orientation not described, narrowly lanceolate, (3.5-) 4 - 5 $\times$ 0.6 - 1.2 mm, basally $\pm$ united, acute, white, tinged with red or with pink midvein; **Ca** 4 mm, erect, glabrous, with reddish lines; **Se** $\pm$ 0.5 mm, reddish-brown, striate.

A member of Ser. *Subrosea* 't Hart. – [U. Egli]

S. nevii A. Gray (Mem. Amer. Acad. Arts, n.s., 6: 373, 1858). **T:** USA, Alabama (*Nevius* s.n. [GH]). – **D:** E USA (disjunct in the S Appalachian Highlands); in partial shade on living mats of mosses and lichens. **I:** Fröderström (1936a: 111, t. 73); Clausen (1975: 110).

Incl. *Sedum beyrichianum* Masters (1878) $\equiv$ *Sedum nevii* var. *beyrichianum* (Masters) Praeger (1917).

[2] Glabrous perennial herbs with slender pale green decumbent primary stems, forming tufts; **L** loosely crowded, alternate, elliptic, oblanceolate, spatulate or obovate, rounded, margins papillose, shortly spurred, petiolate, subterete, 6 - 11 $\times$ 2.5 - 3.2 mm, green or greyish-green; flowering **Br** erect or pending, 6.2 - 8.3 cm; **Inf** cymes with 3 **Br**, sometimes dichotomously forked; **Bra** **L**-like but smaller; **Fl** 4-merous, sessile or subsessile; **Sep** broadly sessile, basally slightly connate, unequal, linear or linear-lanceolate, obtuse, green, $\pm$ 6 $\times$ 1 mm; **Pet** free, lanceolate, carinate, acute, white, $\pm$ 5.5 mm; **Fil** white; **Anth** red; **NSc** subquadrate or square, truncate, sometimes emarginate, white; **Fr** stellate, with conspicuous lips along the ventral suture, brown; **Se** elliptically pear-shaped, brown, co-state. – *Cytology*: $2n = 12$.

This taxon is close to *S. glaucophyllum* and may be synonymous with it (Clausen 1975).

S. niveum Davidson (Bull. South. Calif. Acad. Sci. 20: 53, 1921). **T:** USA, California (*Kessler* 3430 [LAM]). – **D:** W USA (California); Mexico (N Baja California); quartzite soil on N slopes, 1500 - 3000 m. **I:** Fröderström (1936a: 97, t. 62); Clausen (1975: 178).

$\equiv$ *Cockerellia nivea* (Davidson) A. Löve & D. Löve (1985).

[1] Glabrous perennial herbs with tuberous tufted **R** and repent branched frutescent primary stems, which produce **Ros**; **L** alternate, obovate to oblanceolate, rounded or obtuse, papillose, tip bluntly submucronate, subterete, sessile, 6 - 10 $\times$ 2.2 - 4.2 mm, dark green to yellow-green, speckled with red; flowering **Br** erect or ascending, $\pm$ 2.5 cm; **Inf** cymes with 1 - 3 **Br**; **Bra** **L**-like but smaller; **Ped** to 1 mm; **Fl** 5- (to 8-) merous; **Sep** basally free, very unequal, lanceolate, oblong-lanceolate or oblanceolate-elliptic, acute to obtuse, sometimes papillose,

4.4 - 7.2 $\times$ 1.2 - 1.7 mm, divergent or suberect; **Pet** basally slightly connate, lanceolate, acute, with a mucronate appendage, white, streaked with pink, $\pm$ 7 mm, basal $\frac{1}{3}$ erect, then widely divergent, frequently forked; **Fil** white, streaked with red; **Anth** dark red; **NSc** reniform, stipitate or subquadrate, truncate or emarginate, yellow, orange or pink; **Sty** slender, white, divergent, 1 - 1.5 mm; **Fr** erect, basally connate, pale brown; **Se** pear-shaped, dark brown or reddish-brown, obscurely reticulate. – *Cytology*: $2n = 32, \pm 128$.

S. nokoense Yamamoto (Suppl. Icon. Pl. Formos. 2: 21, 1926). **T:** Taiwan [Formosa], Prov. Taihoku (*Matsuda* s.n. [TI]). – **D:** Taiwan; endemic in the C mountains, 2500 - 3500 m. **I:** Tang & Huang (1989: 173); Tang & Huang (1993: 30).

Incl. *Sedum taiwanicum* S. S. Ying (1986).

[1] Perennial herbs with basally decumbent stems, branched above, glandular-spotted, 9 - 20 cm tall; **L** alternate, spatulate, obtuse, fleshy, 6 - 10 $\times$ 3 - 5 mm; **Inf** spike-like cymes; **Fl** 5-merous, sessile; **Sep** broadly sessile, unequal, oblanceolate, subspatulate or linear-lanceolate, obtuse, cuneate at the base, $\pm$ 3 $\times$ 1 mm; **Pet** linear-lanceolate, subacuminate, 1-veined, yellow, $\pm$ 5 $\times$ 1.5 mm; **Anth** yellow; **Fr** stellately patent; **Se** oblong, smooth.

Similar to the Japanese *S. makinoi* (Ohba 2001: 23).

S. nothodugueyi K. T. Fu (Acta Phytotax. Sin. 12(1): 55, t. 12: 20-28, 1974). **T:** China, Sichuan (*Chu* 3967 [PE]). – **D:** China (W Sichuan); rocks, $\pm$ 2300 m. **I:** Fu & Fu (1984: t. 21); Byalt (2001a: 34).

[1] Perennial herbs with erect strongly napiform rhizome; stems 3 - 6 cm; **L** alternate, narrowly triangular-lanceolate to linear, acuminate, 2 - 6 $\times$ $\pm$ 1 mm, with a short mostly trilobate spur; flowering **Br** 4 - 10 cm, clustered and erect, slender, densely leafy; **Inf** few-flowered corymbs; **Bra** **L**-like; **Ped** 1 - 3 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, narrowly lanceolate to triangular, acuminate, 5 - 5.6 $\times$ $\pm$ 1 mm; **Pet** basally slightly connate, lanceolate to ovate, long mucronate, yellow, 6 - 6.5 mm; **NSc** broadly spatulate, rounded; **Fr** erect, few-seeded; **Se** ovate-oblong, smooth or papillate.

The collection given as type in the protologue is also the type collection of *S. holopetalum*. Should the same herbarium sheet be the holotype of the 2 names, *S. nothodugueyi* would automatically but unintentionally turn into a synonym of *S. holopetalum*. Although both species seem to be closely related, we keep them apart. *S. nothodugueyi* is moreover close to *S. heckelii*, but differs in several characters.

S. nudum Aiton (Hort. Kew. 2: 112, 1789). – **D:** S and E Madeira; coastal regions to 500 m. **I:** 't Hart (1999a).

Incl. *Sedum suffruticosum* Solander ms. (s.a.) (*nom. inval.*, Art. 29.1).

[1] Glabrous subshrubs 6 - 10 (-20) cm tall, with much-branched shoots ascending from a woody stout basal stem or with suberect shoots ascending from a diffuse somewhat woody sympodial base, young **Br** usually mamillate, scabrous; **L** alternate, sessile, crowded at the shoot tips, narrowly linear to oblong, 3 - 6 (-9) mm, obtuse to rounded, terete to subterete, bright green or yellowish, often tinged with red; flowering **Br** erect or scending, 5 - 10 cm; **Inf** few-flowered cymes with 2 - 3 often lax cincinni; **Bra** 2 per **Fl**; **Fl** 5-merous, subsessile or shortly pedicellate; **Sep** basally free, spurred, unequal, ovate, ± 2 mm, obtuse to rounded; **Pet** basally slightly connate, narrowly oblong-elliptic, 3 - 4 mm, acute, yellow, often tinged red in bud; **Fil** yellow; **Anth** yellow; **NSc** spatulate, yellowish; **Sty** slender; **Fr** stellately patent to substellate, yellowish-brown, with lips along the suture; **Se** pale brown, reticulate-papillose. – *Cytology*: $2n = 26$.

Closely resembling *S. brissemoretii*, but differing by narrower bright green leaves, smaller flowers and woodier stems. It occurs in much dryer habitats (rocks exposed to the S) and belongs to the comparium of Ser. *Macaronesia* Fröderström. – [H. 't Hart]

S. nussbaumerianum Bitter (Notizbl. Bot. Gart. Berlin-Dahlem 8: 281-284, 1924). **T**: Mexico, Veracruz (*Purpus* s.n. [B ?]). – **D**: Mexico (Veracruz); locally naturalized in Sicily and on Fuerteventura. **Fig. XXXVIII.d**

Incl. *Cotyledon rosetifolia* Hort. Berlin-Dahlem (s.a.) (*nom. inval.*, Art. 34.1c).

[1] Glabrous perennial subshrubs with decumbent glabrous stems; **L** alternate, oblanceolate-elliptic, acute, subterete but obscurely carinate, yellow-green to orange, $22 - 39 \times 10 - 16$ mm; flowering **Br** ascending, axillary; **Inf** pleiochasial cymes but appearing umbellate, with a short primary axis; **Ped** 12 - 18 mm; **Fl** 5- (rarely 4-) merous, slightly fragrant; **Sep** broadly sessile, basally connate, ovate, acute, pale green, $\pm 2.5 \times 1.5$ mm; **Pet** basally connate, lanceolate, acute, white, ± 7.5 mm; **Fil** white; **Anth** salmon-pink; **NSc** square, truncate and emarginate, white; **Se** reticulate. – *Cytology*: $2n = 128$.

Probably identical with *S. adolphi*. Fröderström (1936a: 24) regarded it as a synonym of *S. adolphi*, but Clausen (1959: 107) distinguished both species, though stressing their resemblance.

S. nuttallianum Rafinesque (Atl. J. 1: 146, 1832). **T**: USA, Arkansas (*Nuttall* s.n. [NY]). – **Lit**: Nesom & Turner (1996). **D**: C USA (Texas, Oklahoma, Arkansas, Missouri); open areas in shallow soil, commonly over granite or sandstone. **I**: Fröderström (1936a: 135, t. 91); Clausen (1975: 313).

Incl. *Sedum nuttallii* Eaton (1833); **incl.** *Sedum*

torreyi G. Don (1834); **incl.** *Sedum sparsiflorum* Nuttall (1840).

[1] Glabrous small annual herbs with erect or decumbent, simple or branched smooth stems from a slender tapR; **L** alternate, narrowly lanceolate-elliptic or oblong, obtuse, shortly spurred, subterete to rarely globular, $3 - 6 \times 1.5 - 2$ mm, pale or bluish-green, widely divergent; flowering **Br** erect, 2.4 - 10.7 cm; **Inf** cymes with 1 - 3 **Br**; **Bra** L-like; **Fl** 5-merous, sessile or subsessile; **Sep** basally free, shortly spurred, very unequal, lanceolate or lanceolate-oblong, acute, yellow-green, $0.6 - 3 \times 0.4 - 1.5$ mm; **Pet** free, elliptic-oblong, with a mucronate appendage, slightly cucullate, yellow, 2 - 4 mm, spreading; **Fil** yellow; **Anth** yellow; **NSc** stipitate-reniform, subquadrate or obovate, truncate at the tip, yellow or translucent; **Sty** 0.2 - 1 mm; **Fr** widely spreading, with conspicuous lips along the ventral suture, straw-yellow; **Se** ovoid, yellow-brown, reticulate-papillose. – *Cytology*: $2n = 20$.

Another member of the *S. parvum* group (Nesom & Turner 1996). – [H. 't Hart, B. Bleij & U. Eggli]

S. oaxacanum Rose (CUSNH 13(9): 299, 1911). **T**: Mexico, Oaxaca (*Pringle* 10243 [US 462270, ENCB, S]). – **D**: Mexico (Oaxaca); ± 3500 m. **I**: Fröderström (1936a: 88, t. 56). **Fig. XXXVIII.e**

Incl. *Sedum polyrhizum* Praeger (1921) (*nom. inval.*, Art. 34.1b).

[1] Tufted perennial herbs with roughened prostrate much-branched stems, rooting, to 15 cm long; **L** alternate, oblong to obovate, obtuse, slightly mamillate, broadly spurred, subterete, 3 - 6 mm; flowering **Br** erect; **Inf** few-flowered leafy corymbs; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, equal, linear to narrowly triangular, subobtuse, 3 - 4 mm, suberect; **Pet** almost free to the base, suboblong, obtuse, broad below the tip, narrowly mucronate, yellow, 7 - 8 mm, suberect; **NSc** broader than long, trapezoid, flat; **Sty** rather long; **Fr** stellately spreading, turgid; **Se** ovoid, reticulate-papillose. – *Cytology*: $2n = 68$.

The incompletely known *S. polyrhizum* probably belongs here.

S. obcordatum R. T. Clausen (Bull. Torrey Bot. Club 68: 474-475, fig. 1, 1941). **T**: Mexico, Vera Cruz (*Balls* 4600 [US 1793671, K]). – **D**: Mexico (Veracruz: Orizaba and Cofre de Perote). **I**: Clausen (1959: 172). **Fig. XXXVIII.f**

[1] Glabrous perennial subshrubs with caespitose, erect or ascending, much branched stems with peeling bark and easily breaking **Br**; **L** decussate, sometimes alternate, obcordate, obovate or suborbicular, emarginate or broadly rounded, shortly spurred, glaucous, bluish, $7 - 29 \times 6 - 25$ mm; flowering **Br** erect; **Inf** cymes with 1 - 5 **Br**; **Bra** elliptic or obovate; **Ped** 1 - 7 mm; **Fl** 5- (rarely 4- or 6-) merous; **Sep** basally free, sometimes shortly spurred, unequal, oblanceolate-oblong or elliptic-oblong, ob-

tuse, glaucous, pale green, 6.5 - 15.1 × 2.3 - 5.9 mm; **Pet** basally slightly connate, lanceolate, acute or obtuse, mucronate, carinate, glaucous, yellow, greenish at the base, ± 10 mm; **Fil** yellow; **Anth** yellow; **NSc** reniform or subquadrate, truncate, whitish to pale yellow; **Fr** divergent, straw-coloured; **Se** fusiform, verrucose, brown; – *Cytology*: 2n = 68.

S. oblanceolatum R. T. Clausen (Sedum North Amer., 403-404, ill., 1975). **T**: USA, Oregon (Clausen 651034 [CU]). – **D**: W USA (Oregon: Klamath Mts.; drainage of the Applegate River); 450 - 1580 m.

[1] Glabrous perennial herbs with short slender branched **R**stocks, with dense clusters of **Ros**; **L** alternate, oblanceolate-oblong, obtuse to truncate, at times emarginate, pruinose, 7 - 38 × 5 - 9 mm, erect; flowering **Br** ± 8 cm; **Inf** dense panicles; **Fl** 5-merous, pedicellate; **Sep** broadly sessile, basally connate, lanceolate-oblong, acute, papillose, glaucous, ± 5 × 2 mm, erect; **Pet** basally connate, oblong, acute, mucronate, margins erose, creamy-white, ± 9.5 mm, erect; **Anth** yellow; **NSc** transversely oblong, deeply retuse, yellow; **Fr** erect, basally connate, brown; **Se** pear-shaped, brown, costate. – *Cytology*: 2n = 30.

S. obrutellatum K. T. Fu (Acta Phytotax. Sin. 12(1): 63, t. 10: 36-43, 1974). **T**: Tibet (Wang 66274 [PE]). – **D**: SE Tibet, China (NW Yunnan); mountain slopes along rivers, 2400 - 3300 m. **I**: Fu & Fu (1984: t. 25).

[1] Annual or biennial herbs, usually branched, 3 - 8 cm tall; **L** alternate, crowded below, more laxly arranged above, linear- or ovate-lanceolate, obtuse to acute or acuminate, 4 - 5 × ± 1.5 mm, with a short broad truncate spur; **Inf** corymbose; **Ped** 2 - 3 mm; **Fl** 5-merous; **Sep** basally free with a long obtuse spur, unequal, lanceolate to lanceolate-oblong, acute, 3.5 - 4.2 × 0.8 - 1.2 mm; **Pet** free at the base, (narrowly) obrutellate, obtuse to acute, unguiculate, red, ± 2.5 mm; **NSc** linear, obtuse to truncate; **Sty** short; **Fr** suberect; **Se** reticulate-papillose.

Close to *S. raymondii* but differing by its lanceolate to lanceolate-oblong sepals, red narrowly obrutellate unguiculate petals, linear rounded nectary scales, and carpels abruptly ending in the short style.

S. obtusatum A. Gray (Proc. Amer. Acad. Arts 7: 342, 1868). **T**: USA, California (Brewer 1678 [GH]). – **Lit**: Denton (1978). **D**: W USA.

≡ *Gormaniana obtusata* (A. Gray) Britton (1903) ≡ *Cotyledon obtusata* (A. Gray) Fedde (1904) ≡ *Echeveria obtusata* (A. Gray) Nelson & Macbride (1913).

[2] Glabrous perennial herbs with elongate stout branched **R**stocks with a terminal **Ros**; offsets axillary; **L** alternate, oblanceolate or spatulate, rounded

or truncate, obscurely mucronate, retuse or emarginate, 6 - 22 × 4 - 10 mm, green, blue-green, green suffused with red or red; flowering **Br** ascending, terminal or axillary, 1.6 - 11 cm; **Inf** panicles; **Bra** spatulate to linear-oblong; **Ped** ± 1.5 mm; **Fl** 5-merous; **Sep** broadly sessile, basally slightly connate, ovate or lanceolate, acute or obtuse, slightly subterete, glaucous, ± 4 × 2 mm, pale green or purplish, erect; **Pet** basally connate, convolute in bud, oblanceolate-oblong, spatulate or obovate, abruptly mucronate, erose at the upper margins, white to yellow, ± 7.5 mm, spreading above the middle; **Fil** white or yellow; **Anth** yellow; **NSc** truncately reniform, white or yellow; **Fr** erect, brown; **Se** pear-shaped, brown, costate.

S. obtusatum ssp. **boreale** R. T. Clausen (Bull. Torrey Bot. Club 69(1): 32-33, 1942). **T**: USA, California (Clausen & Trapido 4952 [CU]). – **D**: USA (California: N Sierra Nevada, S Cascade Ranges); 1400 - 1800 m. **I**: Clausen (1975: 374). **Fig. XXXVIII.a**

[2] Differs from ssp. *obtusatum*: Flowering **Br** 9 - 11 cm; **Pet** white, greenish-white, creamy-white or pale orange suffused with pink, 6 - 9 × 2.4 - 3.8 mm; **Anth** 1.2 - 1.5 mm; **NSc** 0.9 - 1.2 mm wide. – *Cytology*: 2n = 30.

S. obtusatum ssp. **obtusatum** – **D**: W USA (California: C Sierra Nevada N-wards to the Klamath Mts.); on granite to diorite outcroppings, mostly on W slopes, 1370 - 3660 m. **I**: Clausen (1975: 359).

Incl. *Gormaniana burnhamii* Britton (1903) ≡ *Cotyledon burnhamii* (Britton) Fedde (1904) ≡ *Sedum burnhamii* (Britton) A. Berger (1930); **incl.** *Gormaniana hallii* Britton (1903) ≡ *Sedum hallii* (Britton) Praeger (1921) ≡ *Sedum obtusatum* var. *hallii* (Britton) Smiley (1921) ≡ *Echeveria hallii* (Britton) A. Berger (1930) (*nom. inval.*, Art. 34.1c); **incl.** *Cotyledon yosemitense* Fedde (1904); **incl.** *Echeveria brittonii* Nelson & Macbride (1913) (*nom. illeg.*, Art. 52.1); **incl.** *Sedum rubroglaucum* Praeger (1919); **incl.** *Sedum obtusatum* ssp. *typicum* R. T. Clausen (1940) (*nom. inval.*, Art. 24.3).

[2] **Sep** 1.8 - 5 mm, obtuse to acute; **Pet** yellow (or red-veined), 8 - 10 × 3.2 - 4.1 mm; **Anth** 1.7 - 1.8 mm. – *Cytology*: 2n = 30.

S. obtusatum ssp. **paradisum** Denton (Brittonia 30(2): 236-238, ill., 1978). **T**: USA, California (Denton 4097 [WTU]). – **D**: USA (California: Trinity Mts.); granite outcrops, 300 - 1400 m.

≡ *Sedum paradisum* (Denton) Denton (s.a.).

[2] Differs from ssp. *obtusatum*: **Ros** more compact; **Sep** 3.5 - 6 mm, acute to long-tapering; **Pet** cream-coloured. – *Cytology*: 2n = 30. – [U. Eggli]

S. obtusatum ssp. **retusum** (Rose) R. T. Clausen (Sedum North Amer., 375, 1975). **T**: USA, Califor-

nia (Heller s.n. [US]). – **D:** W USA (California: North Coast Mts. to Siskiyou Mts.); outcrops of granite etc., (460-) 1480 - 2280 m.

≡ *Gormania retusa* Rose (1903) ≡ *Cotyledon retusa* (Rose) Fedde (1904) (*nom. illeg.*, Art. 53.1) ≡ *Sedum laxum* ssp. *retusum* (Rose) R. T. Clausen (1942); **incl.** *Sedum sanhedrinum* A. Berger (1930).

[2] Differs from ssp. *obtusatum*: Flowering **Br** ± 7 cm; **Fl** subsessile; **Pet** white, greenish-white, creamy-white or pale orange suffused with pink, 6 - 9 × 2.4 - 3.8 mm; **Anth** 1.2 - 1.5 mm; **NSc** 0.7 - 0.8 mm wide. – *Cytology*: 2n = 60.

S. obtusipetalum Franchet (J. Bot. (Morot) 10: 289, 1896). **T:** China, Yunnan (*Delavay* 2509 [P]). – **D:** Nepal, China (SW Sichuan, NW Yunnan); rocks on forested slopes, moist soil and sandy places, 2000 - 3700 m.

[1] Annual herbs with ascending or suberect to erect, smooth or sparsely papillate stems, branched throughout, 4 - 15 cm tall; **L** alternate, ± imbricate, appressed to suberect, lanceolate to oblong-lanceolate, linear-elliptic or narrowly oblong, obtuse to acute, broadly spurred, thick, smooth, rarely with mamillate margins, 4 - 11 × 0.8 - 2.5 mm; **Inf** compact cymes; **Bra** L-like; **Ped** 1 - 3 mm; **Fl** 5-merous; **Sep** basally free, broadly spurred, linear to broadly lanceolate, obtuse, sometimes acute, ± fleshy, smooth, rarely with papillose margins, 3 - 6 × 0.9 - 1.8 mm; **Pet** basally connate for up to 2 mm, obtuse to acute, very shortly mucronate, yellow, 6 - 8.5 mm, suberect; **Anth** deep yellow; **Sty** 1 - 2 mm; **Fr** erect; **Se** reticulate-papillose.

S. obtusipetalum ssp. *dandy anum* Hamet ex H. Ohba (J. Jap. Bot. 61(9): 274, ill. (p. 271), 1986). **T:** Nepal (*Stainton & al.* 9011 [BM, TI]). – **D:** Nepal; ± 3700 m.

[1] Differs from ssp. *obtusipetalum*: **Inf** few-flowered; **Pet** oblong-elliptic, ± 2.5 mm broad; **NSc** linear, ± 1.1 mm.

S. obtusipetalum ssp. *obtusipetalum* – **D:** China (SW Sichuan, NW Yunnan); 2000 - 3700 m. **I:** Fröderström (1931: 70, t. 36); Fu & Fu (1984: t. 23).

Incl. *Sedum constantinii* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Sedum mosoynense* Franchet (1896); **incl.** *Sedum costantinii* Hamet (1909); **incl.** *Sedum morotii* Hamet (1909); **incl.** *Sedum rosei* Hamet (1910); **incl.** *Sedum pinoyi* Hamet (1919) ≡ *Sedum morotii* var. *pinoyi* (Hamet) Fröderström (1931); **incl.** *Sedum paracelatum* Fröderström (1942); **incl.** *Sedum rosei* var. *brevistamineum* Fröderström (1942); **incl.** *Sedum rosei* var. *magniflorum* Fröderström (1942).

[1] **Inf** many-flowered; **Pet** linear, linear-lanceolate or broadly lanceolate, 0.9 - 1.8 mm broad; **NSc** broadening abruptly towards the tip, 0.5 - 0.6 mm.

Fu & Fu (1984) treated *S. costantinii*, *S. morotii*, *S. paracelatum* and *S. rosei* as distinct species.

S. ochroleucum Chaix (in Villars, Hist. Pl. Dauphiné 1: 325, 1786). **T:** France, Dauphiné (*Anonymus* s.n. [not located]). – **Lit:** 't Hart (1978). **D:** Switzerland, France, Italy, Albania, Bulgaria, Hungary, Romania, Serbia, Croatia, Macedonia, Slovenia, Greece, Turkey (European part).

≡ *Sedum rupestre* ssp. *ochroleucum* (Chaix) Hegi & Em. Schmid (1922); **incl.** *Sedum anopetalum* De Candolle (1808) ≡ *Sedum rupestre* ssp. *anopetalum* (De Candolle) Arcangeli (1882) ≡ *Petrosedum anopetalum* (De Candolle) Grulich (1984) ≡ *Petrosedum rupestre* ssp. *anopetalum* (De Candolle) Velayos (1989); **incl.** *Sedum rufescens* Tenore (1811); **incl.** *Sedum hispanicum* De Candolle (1815) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum verlottii* Jordan (1860).

[1] Glabrous perennial herbs; sterile **Br** ± procumbent, rooting; **L** imbricate, linear-oblong, mucronate, terete, basally spurred, 10 - 15 mm, green or glaucous; flowering **Br** erect or ascending, 15 - 40 cm; **Inf** terminal corymbs with 3 - 5 **Br**, densely glandular-pubescent, erect and flat-topped in bud, **Br** scarcely recurved; **Bra** L-like, glandular-pubescent; **Fl** (5- to) 6- to 8-merous, subsessile; **Sep** basally connate, equal, triangular, long acuminate, 5 - 7 mm, densely glandular-pubescent; **Pet** free, oblong, cream-coloured or greenish-white, 8 - 10 mm, erect during anthesis; **Fil** white, glabrous; **Anth** yellow; **NSc** square, greenish; **Fr** erect, brown; **Se** oblong, brown, costate. – *Cytology*: 2n = 34, 68, 102.

S. oculense J. Meyrán (Cact. Suc. Mex. 36(4): 92-96, ill., 1991). **T:** Mexico, México (*Bonilla* s.n. in *Meyran* 5061 [MEXU, ENCB]). – **D:** Mexico (México); 2000 - 2250 m.

[1] Glabrous perennial subshrubs with erect then decumbent or pendent stems, branching at the base, to 18 cm long; **L** alternate, spatulate to oblong-obovate, obtuse to rounded, flat to subterete, 18 - 30 × 7 - 11 mm, 4 - 5 mm thick; flowering **Br** axillary; **Inf** compact few-flowered cymes with 3 - 5 **Br**; **Bra** oblong to linear, rounded, 2 on every cincinnus; **Ped** 2 - 3 mm; **Fl** 5-merous; **Sep** slightly unequal, oblong, lanceolate to ovate, obtuse, slightly ascending, carinate, subterete, 3 - 4 × 1 - 2 mm, 1 - 2 mm thick at the tip, less towards the base; **Pet** basally slightly connate, rhomboid, acute, white, 5 - 7 mm; **Fil** white; **Anth** dark red; **NSc** rectangular, emarginate, dark red.

S. oligocarpum Fröderström (Acta Horti Gothob. 15: 26, figs. 164-172, t. 4: 2, 1942). **T:** China, Sichuan (*Smith* 11263 [UPS ?]). – **D:** China (W Sichuan); rocks, 4400 - 4600 m.

[1] Tiny annual herbs to 1 cm tall, strongly branched from the base; **Br** divaricate; **L** ovate or suborbicular, obtuse, 1 - 1.5 mm; **Inf** small, few-flowered; **Bra** 2 per **Fl**, subopposite, lanceolate, apiculate, 1.5 - 2 mm; **Ped** short; **Fl** 5-merous, with 5 **St**; **Sep** subovate, subacute, 1.5 - 2 mm; **Pet** oblong, mucronate, broad at the base, yellowish, ± 2

mm; **NSc** narrowly linear, very slightly emarginate; **Sty** long; **Fr** subdivergent, few-seeded; **Se** lanceolate, probably reticulate.

S. oligospermum Maire (Bull. Soc. Hist. Nat. Afr. Nord 30(4-5): 278, 1939). **T:** China (*von Rosthorn* 787 [B ?]). – **D:** Myanmar, China (Gansu, Henan, Hubei, Hunan, Shaanxi, Sichuan, Yunnan); shady moist slopes in forests, rocks; 1100 - 2800 m.

Incl. *Sedum bracteatum* Diels (1900) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum amplibracteatum* K. T. Fu (1974) (*nom. illeg.*, Art. 52.1).

[1] Perennial herbs; **L** alternate or in whorls of 3, oblong to obovate, subobtusely to subacute, long pseudo-petiolate, 3 - 7 cm, deciduous towards the stem base; flowering **Br** weak, fleshy, to 50 cm; **Inf** lax cymes with ± 3 cincinni, these sometimes forked; **Bra** (sub-) orbicular, to 6 mm; **Fl** 5-merous; **Sep** broadly sessile, triangular, subacute, ± 0.5 mm; **Pet** oblong, subacute, 5 - 6 mm, yellowish; **Sty** to 5 mm; **NSc** linear-subspatulate; **Fr** subdivergent, few-seeded; **Se** large, fusiform.

Related to *S. wilsonii*, *S. tetractinum*, *S. triactinum* and *S. leptophyllum*, and classified in Ser. *Bracteata* (Fröderström) S. H. Fu (Fu & Fu 1984). These species have no affinities, however, with *Phedimus*, notwithstanding their flat and relatively large leaves and broadly sessile sepals, but belong to *Sedum* s.str. and may be close to Ser. *Japonica*, which is characterized by flat, alternate or whorled leaves, yellow flowers and reticulate or reticulate-papillose seeds.

The nomenclaturally correct name for this taxon was only recently pointed out by Byalt (2001b). – [H. 't Hart, B. Bleij & U. Eggli]

S. oligospermum var. **emarginatum** (S. H. Fu) Byalt (Novosti Sist. Vyssh. Rast. 33: 131, 2001). **T:** China, Sichuan (*Hsiung & Chow* 92738 [PE]). – **D:** China (Sichuan); ± 1800 m.

$\equiv$ *Sedum bracteatum* var. *emarginatum* S. H. Fu (1965) (*incorrect name*, Art. 11.4) $\equiv$ *Sedum amplibracteatum* var. *emarginatum* (S. H. Fu) S. H. Fu (1984) (*incorrect name*, Art. 11.4).

[1] **L** tips emarginate.

S. oligospermum var. **oligospermum** – **D:** China (Yunnan, Sichuan to Hunan); 1000 - 3000 m. **I:** Fröderström (1931: 101, t. 63-64, as *S. bracteatum*).

Incl. *Sedum amplibracteatum* var. *amplibracteatum* (*incorrect name*, Art. 11.4).

[1] **L** tips entire.

S. onychopetalum Fröderström (Sinensia 3: 199, 1933). **T:** China, Jiangsu (*Lu & Teng* 9636 [Herb. Nanking]). – **D:** China (Anhui, Jiangsu, Zhejiang); shady moist rocks in open places, ± 200 m. **I:** Fröderström (1936a: 163); Fu & Fu (1984: t. 31).

[1] Perennial herbs with slender suberect stems 2 - 4 cm tall; **L** opposite or in whorls of 3 - 4, broadly

linear or lanceolate, subobtusely, broadly spurred, 6 - 11 mm; flowering **Br** several, suberect, simple, 8 - 12 cm; **Inf** large cymes with 2 or 3 sometimes forked cincinni; **Bra** suboblong, obtuse, ± 5 mm; **Fl** 5-merous; **Sep** broadly sessile, almost equal, suboblong, obtuse, ± 2.5 mm; **Pet** free at the base, lanceolate, mucronate, subunguiculate, yellow, ± 5 mm; **NSc** subquadrate, flat; **Sty** long; **Fr** divergent, inflated; **Se** small, subovoid, probably reticulate-papillose.

S. orbatum Moran & J. Meyrán (Cact. Suc. Mex. 33(3): 55-59, 76, ill., 1988). **T:** Mexico, Puebla (*Otero* 62 [MEXU, ENCB]). – **D:** Mexico (Puebla: known from cultivated plants only).

[1] Glabrous perennial subshrubs, stems few-branched, ≥ 25 cm; **L** alternate, narrowly cuneate-obovate, obtuse or rounded, mucronate, slightly subterete, 35 - 60 $\times$ 15 - 35 mm, lustrous, greenish-yellow or dark green; flowering **Br** axillary, 12 - 20 cm, reddish-purple, slightly glaucous; **Inf** compact thyrses; **Bra** similar to the **L** on flowering **Br**; **Fl** 5- (to 6-) merous, subsessile; **Sep** unequal, oblong-lanceolate, obtuse, 2 - 3 $\times$ ± 1 mm; **Pet** basally slightly connate, imbricate in bud, ovate-lanceolate, subacute, white, 3 - 4.5 mm; **Fil** white; **Anth** light yellow; **NSc** subquadrate-cuneate, $\pm$ orange; **Sty** to 1.5 mm. – *Cytology*: 2n = 68.

S. oreades (Decaisne) Hamet (Bull. Soc. Bot. France 56: 571, 1909). **T:** India, Kashmir (*Jacquemont* 1238 [P]). – **D:** N Pakistan, India (Kashmir), Sikkim Bhutan, Tibet, Myanmar, China (NW Yunnan); stony places, 3000 - 4500 m. **I:** Fröderström (1931: 42, t. 25); Fu & Fu (1984: t. 20). **Fig. XXXVIII.g**

$\equiv$ *Umbilicus oreades* Decaisne (1844) $\equiv$ *Cotyledon oreades* (Decaisne) C. B. Clarke (1878); **incl.** *Sedum taeschkei* Kurz (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Umbilicus luteus* Decaisne (1844) (*nom. illeg.*, Art. 53.1); **incl.** *Umbilicus spathulatus* Hooker fil. & Thomson (1858) $\equiv$ *Cotyledon spathulata* (Hooker fil. & Thomson) C. B. Clarke (1878) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum jaeschkei* Kurz (1867); **incl.** *Sedum filicaule* Duthie ex Hamet (1909) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum squarrosus* Royle ex Hamet (1909) (*nom. inval.*, Art. 34.1c).

[1] Perennial herbs with few small usually very short stems; **L** alternate, $\pm$ imbricate, lanceolate to broadly oblong, shortly acuminate, 3 - 9 $\times$ 1 - 1.5 mm, with an obtuse trilobate spur; flowering **Br** ascending or erect, branched, 2.5 - 14 cm; **Inf** 1- to many-flowered corymbs; **Fl** 5- (to 7-) merous, with 5 or 10 (-14) **St**; **Sep** basally free, shortly spurred, lanceolate, sometimes minutely erose at the margins, 5 - 6 $\times$ 1.5 - 2 mm; **Pet** basally connate for up to 3 mm, obovate, shortly mucronate, narrowly unguiculate, with erose margins, yellow, 6 - 12 mm; **NSc** linear-subspatulate, rounded to truncate; **Fr** erect, many-seeded; **Se** reticulate-papillose.

S. oreganum Nuttall (in Torrey & A. Gray, Fl. North Amer. 1: 559, 1840). **T:** USA, Washington (Nuttall s.n. [BM]). – **D:** W USA.

≡ *Gormaniana oregana* (Nuttall) Britton (1903) ≡ *Cotyledon oregana* (Nuttall) Fedde (1904) ≡ *Echeveria oregana* (Nuttall) Nelson & Macbride (1913) ≡ *Breitungia oregana* (Nuttall) A. Löve & D. Löve (1985).

[2] Glabrous perennial herbs with stout decumbent branched stems; **L** alternate, cuneate to spatulate, broadly rounded or truncate, thickest near the tip, shortly spurred, lustrous, light green, 7 - 12 × 4.4 - 9 mm; flowering **Br** erect, 8 - 13 cm; **Inf** dense corymbs with primary **Br** dichotomously forked; **Bra** spatulate or oblanceolate, spurred, 5 - 8 mm; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, ovate-lanceolate, acuminate or acute, green, ± 3.5 × 2 mm, erect; **Pet** basally connate, narrowly lanceolate, aristate, carinate, yellow, ± 10.5 mm, divergent upwards; **Fil** yellowish or greenish; **Anth** yellow; **NSc** subquadrate or spatulate, yellow; **Fr** erect, light brown or yellow; **Se** pear-shaped, brown, costate. – *Cytology*: 2n = 24.

S. oreganum ssp. **oreganum** – **D:** SW Canada, NW USA (Alaska to Oregon); exposed and sunny coastal bluffs and cliffs, to 460 m. **I:** Clausen (1975: 346).

Incl. *Sedum oreganum* var. *metallicum* Hort. Schleipfer (s.a.) (*nom. inval.*, Art. 29.1).

[2] Stems stout; **L** thick; **Sep** ± 3.5 mm; **NSc** subquadrate to spatulate.

S. oreganum ssp. **tenue** R. T. Clausen (Sedum North Amer., 355, 1975). **T:** USA, Washington (Clausen & Clausen 61.209.4 [CU]). – **D:** SW Canada, NW USA (British Columbia to Oregon: Cascade Mts.); 300 - 1550 m.

[2] Differs from ssp. *oreganum*: Stems more slender; **L** thinner; **NSc** somewhat more elongate; **Ca** shorter; **Se** smaller.

S. oregonense (S. Watson) M. Peck (Man. Higher Pl. Oregon, 361, 1941). **T:** USA, Oregon (Howell & Howell 322 [GH]). – **D:** W USA (Oregon, N California: Cascade and Klamath Mts.); 1190 - 1590 m. **I:** Clausen (1975: 411).

≡ *Cotyledon oregonensis* S. Watson (1882); **incl.** *Gormaniana watsonii* Britton (1903) (*nom. illeg.*, Art. 52.1) ≡ *Echeveria watsonii* (Britton) Nelson & Macbride (1913) (*nom. illeg.*, Art. 52.1) ≡ *Sedum watsonii* (Britton) Tidestrom (1927) (*nom. illeg.*, Art. 52.1).

[2] Glabrous perennial herbs with thick much-branched **R**stock with fleshy **Ros**; **L** alternate, obovate or oblanceolate, emarginate to retuse, sessile to sometimes subsessile, subterete, 10 - 36 × 5 - 16 mm, green and glaucous; flowering **Br** erect, 6 - 28 cm; **Inf** panicles; **Bra** L-like; **Fl** 5-merous, pedicellate; **Sep** broadly sessile, basally connate, ovate,

subacute, ± 3.5 × 0.5 mm, greenish, erect, appressed to the **Cl** tube, persistent; **Pet** basally connate, elliptic-oblong or oblanceolate-oblong, with erose margins, cucullate, whitish, erect at the base and divergent apically, persistent through **Fr** time; **Fil** pale yellow; **Anth** yellow; **NSc** subreniform, truncate, white or yellow; **Fr** erect, brown, with 5 strong veins; **Se** pear-shaped, pale brown, costate. – *Cytology*: 2n = 90.

S. oteroi Moran (Cact. Suc. Mex. 22(3): 49, 51-54, ill., 1977). **T:** Mexico, Oaxaca (*Otero* 17 [SD 94809]). – **D:** Mexico (Oaxaca); limestone hills, ± 2000 m.

[1] Glabrous perennial herbs with tuberous **R** and short leafy stems, sometimes with lateral **Br**; **L** alternate, closely set, ascending, clavate-oblanceolate to oblong-obovate, broadly acute to obtuse, basally subclasping, papillose towards the tip, esp. at margins and keel, slightly carinate, subterete, turgid, 5 - 10 × 2 - 5 mm, 1.5 - 2.5 mm thick, green or slightly glaucous; flowering **Br** axillary, 3 - 5 cm, pale green, glaucous; **Inf** rather compact racemes; **Bra** L-like but narrower and more acute; **Ped** ± 1.5 mm; **Fl** 5-merous; **Sep** nearly equal, slightly imbricate at the base, oblong, subacute to obtuse, scarcely papillose above, glaucous, ± 3 × 1.5 - 2 mm, ascending; **Pet** basally connate, imbricate in bud, obovate, broadly acute, carinate, glaucous, light yellow, ± 4 mm, ascending-spreading; **Fil** whitish; **NSc** yellow. – *Cytology*: 2n = 54, 144.

S. oxycoccoides Rose (Bull. New York Bot. Gard. 3(9): 40, 1903). **T:** Mexico, Nayarit (*Rose* 2198 [US]). – **D:** Mexico (Nayarit); deep shady ravines. **I:** Fröderström (1936a: 28, t. 18).

[1] Glabrous perennial herbs with creeping fleshy **R**stocks and many slender **Br** from the base, 20 - 32 cm tall; **L** alternate, linear, obtuse, 8 - 15 mm, ± spreading; flowering **Br** erect; **Inf** lax panicles or few-branched cymes; **Bra** linear, ± 5 mm; **Fl** 5-merous, sessile or subsessile; **Sep** basally free, shortly spurred, unequal, linear, obtuse, terete, 4 - 6.5 mm; **Pet** nearly free to the broad base, lanceolate to subovate, subobtuse to acuminate, 5 - 10 mm, deep red; **Fil** reddish; **NSc** large, subquadrate, slightly emarginate, flat, greenish; **Fr** free, turgid, suberect to spreading; **Se** ovoid, reticulate. – *Cytology*: 2n = 58.

S. oxypetalum Kunth (in Humboldt, Bonpland & Kunth, Nov. Gen. Sp. 6: 37-38, 1823). **T:** Mexico (Bonpland s.n. [P]). – **D:** Mexico (C and E Trans-Mexican Volcanic Belt); on conglomerate. **I:** Fröderström (1936a: 20, t. 12); Clausen (1959: 117). **Fig. XXXIX.g**

Incl. *Sedum arborescens* Sessé & Moçino (1894); **incl.** *Sedum peregrinum* Sessé & Moçino (1894).

[1] Perennial shrubs with much-branched stems, flaking bark and papillose twigs, to 1 m tall, fruit-

ing **Br** deciduous with a distinct, predefined abscission layer; **L** alternate, oblanceolate or obovate, retuse or emarginate, finely papillose, green, 11 - 57 × 5 - 21 mm, deciduous after flowering; flowering **Br** erect; **Inf** cymes with 3 or 4 **Br**, sometimes corymbose; **Fl** 5- (or 4- or 6-) merous, sessile, with musky scent; **Sep** basally free, shortly spurred, unequal, lanceolate, acute, green, 1.5 - 4.4 × 0.6 - 1.3 mm, erect; **Pet** basally free, lanceolate, acute, mucronate, white to pink, ± 6 × 1.5 mm, spreading; **Fil** pale pink; **Anth** red, pink or yellow; **NSc** oblong or obovate-oblong, truncate, rounded or emarginate, creamy-white or pale yellow; **Fr** widely divergent, with small lips along the ventral suture, brownish; **Se** pear-shaped, brown, reticulate. – *Cytology*: 2n = 58.

S. pachyphyllum Rose (CUSNH 13(9): 299-300, pl. 58, 1911). **T**: Mexico, Oaxaca (*Purpus* 416 [US 618380]). – **D**: Mexico (Oaxaca: Sierra Madre del Sur). **I**: Fröderström (1936a: 15, t. 8). **Fig. XXXIX.a**

[1] Much branched perennial subshrubs 5 - 30 cm tall; **L** crowded, clavately oblong-oblanceolate, terete, glaucous, 10 - 40 × 6 - 10 mm; flowering **Br** erect or reflexed, axillary; **Inf** corymbs; **Fl** 5-merous, subsessile; **Sep** basally free, shortly spurred, unequal, clavately oblanceolate, obtuse, very thick in the upper part, 3.5 - 5 mm; **Pet** free to the base, subovate, obtuse, broadly mucronate, yellow, 5 - 7 mm; **NSc** small, broader than long, thick, slightly emarginate; **Sty** rather broad and short; **Fr** erect, ovoid; **Se** ovoid, reticulate. – *Cytology*: 2n = 68.

S. pagetodes Fröderström (Acta Horti Gothob. 15: 25-26, figs. 152-163, t. 4: 3, 1942). **T**: China (*Smith* 11827 [UPS ?]). – **D**: China (S Qinghai, W Sichuan); grassland slopes, 3700 - 4600 m.

[1] Small tufted annual herbs, much branched from the base, 2.5 - 4.5 cm tall; **L** alternate, lanceolate to broadly semi-ovate or broadly oblong, obtuse, rounded at the base, 2.5 - 4 mm; **Inf** few-flowered; **Bra** ovate to oblong, broadened basally; **Ped** 1 - 2 mm; **Fl** 5-merous, with (1-) 2 (-3) **Bra** each; **Sep** broadly sessile, subovate to broadly lanceolate, obtuse, 2 - 2.3 mm; **Pet** basally free, suberect below the middle, spreading above, oblong, obtuse, with a short and broad mucro, yellow, 4.2 - 4.5 mm; **NSc** spatulate-oblong, obtuse, broadened towards the tip; **Fr** divergent, few-seeded; **Se** ovoid, probably reticulate.

S. pallidum M. von Bieberstein (Fl. Taur.-Caucas. 1: 353-354, 1808). **T**: Turkey (*M. von Bieberstein* s.n. [LE]). – **D**: SE Bulgaria, N Turkey, N Iran, Russia (Crimea), Georgia (Caucasus); Euxine element restricted to the regions bordering the Black Sea. **I**: Akhiani (2000: 33).

Incl. *Sedum rubens* var. *decandrum* De Candolle (1828); **incl.** *Sedum bithynicum* Boissier (1849) ≡

Sedum glaucum ssp. *bithynicum* (Boissier) Boissier (1872) (*incorrect name*, Art. 11.4) ≡ *Sedum pallidum* var. *bithynicum* (Boissier) Chamberlain (1972); **incl.** *Sedum filicale* Bornmüller (1941) (*nom. inval.*, Art. 36.1).

[1] Glandular-pubescent perennial herbs, usually with branching and rooting sterile shoots at the base of the ascending flowering shoots; **L** alternate, densely imbricate, sessile, shortly spurred, linear to linear-oblong, 6 - 10 mm or rarely longer, terete to semiterete, obtuse to acute, glaucous-green, sometimes red; flowering **Br** to 15 cm; **Inf** cymes with usually 2 - 4 cincinni; **Fl** 5-merous; **Sep** broadly sessile, basally slightly connate, triangular, acute; **Pet** free, lanceolate, white or rarely pinkish, keel often red; **Fil** glabrous; **Anth** red; **Fr** brown, not tuberculate, connate for ¼ of their length; **Se** ovoid, dark brown, costate. – *Cytology*: 2n = 20, 40, 60.

Although generally perennial, the usually non-flowering shoots of some plants may occasionally all produce inflorescences. These apparently monocarpic specimens can be distinguished from the strictly annual *S. eriocarpum* by the basally ascending and usually much-branched stems. – [H. 't Hart, B. Bleij & V. V. Byalt]

S. palmeri S. Watson (Proc. Amer. Acad. Arts 17: 355, 1882). **T**: not located. – **D**: Mexico (Coahuila, Nuevo León); naturalized in Italy. **I**: Fröderström (1936a: 11, t. 4). **Fig. XXXIX.b**

Incl. *Sedum palmeri* ssp. *emarginatum* R. T. Clausen (1981); **incl.** *Sedum palmeri* ssp. *rubromarginatum* R. T. Clausen (1981).

[1] Glabrous perennial subshrubs with several flexuous stems 15 - 25 cm tall; **L** alternate, narrowly spatulate, broadly obovate, pseudopetiolate-obovate in the lower part, obtuse, smooth or finely mamillate, glaucous, 10 - 30 mm; flowering **Br** erect; **Inf** panicles or lax corymbs; **Bra** subovate; **Fl** 5- to 7-merous, pedicellate; **Sep** broadly sessile, unequal, oblong, subacute, 4 - 5.5 mm; **Pet** basally slightly connate, oblong, subobtuse, broadly mucronate, orange-yellow, 6 - 7 mm; **NSc** broader than long, almost flat; **Sty** rather long; **Fr** suberect. – *Cytology*: 2n = 68, 70, 136.

S. pampaninii Hamet (Malpighia 26: 59-63, 1913). **T** [syn]: China, Shaanxi (*Giraldi* s.n. [FI]). – **D**: China (W Henan, S Shaanxi, Sichuan, Yunnan); forested slopes, rocks in ravines, 1000 - 2500 m. **I**: Fröderström (1931: 53, t. 33).

[1] Perennial herbs with several non-flowering stems 2 - 5 cm tall; **L** alternate, ± imbricate, narrowly lanceolate, acute, 4 - 7 mm, with an obtuse spur, persistent when dead; flowering **Br** ascending, often branched, to 7 cm; **Inf** laxly corymbose; **Fl** 5-merous, shortly pedicellate; **Sep** basally free, shortly spurred, semilanceolate, acute, 4 - 6 mm; **Pet** slightly connate at the base, lanceolate, submucronate, yellowish, 6 - 10 mm; **NSc** sub-

quadrate-spatulate; **Fr** erect, basally connate for 2 - 3 mm, each follicle with 4 - 9 **Se**; **Se** large, ovoid, reticulate-papillose.

S. papillicaulum G. L. Nesom (Phytologia 79(4): 265-266, 1996). **T:** Mexico, Nuevo León (*Hinton & al.* 17551 [TEX]). – **Lit:** Nesom & Turner (1996). **D:** Mexico (Nuevo León); subalpine and alpine meadows, (2700-) 3000 - 3600 m.

[1] Erect suffrutescent perennial herbs with fibrous **R**, 6 - 25 cm tall; stems prominently minutely and densely papillate, papillae columnar and sometimes appearing stipitate-glandular; **L** oblong-elliptic to lanceolate-oblong, flat but with a swollen basal part, 3 - 4 × 1.5 - 2.2 mm, equally long throughout the length of the stems; flowering **Br** as in *S. parvum*; **Pet** erect, yellow, rarely with reddish tinge, 5 - 7 mm.

Another member of the *S. parvum* group (Nesom & Turner 1996) and compared with *S. catorce* and *S. macdonaldii* in the protologue. – [U. Eggli]

S. parvisepalum Yamamoto (Suppl. Icon. Pl. Formos. 2: 22, 1926). **T:** Taiwan (*Kawakami & Mori* 2019 [TI]). – **D:** C Taiwan, Philippines; mountainous areas, 1800 - 3000 m.

[1] Perennial succulent herbs with short sterile stems; **L** alternate, remote, very shortly spurred, obtuse, thick, 4 - 6 × 0.9 - 1.7 mm; flowering **Br** ascending or erect, simple or sometimes branched basally; **Inf** dense many-flowered cymes with ± 3 cincinni; **Bra** few, **L**-like; **Fl** 5-merous; **Sep** broadly sessile, basally slightly connate, slightly unequal, linear-lanceolate to very narrowly oblong, rounded, fleshy, 2.5 - 3.5 × ± 0.5 mm; **Pet** basally slightly connate, lanceolate, acute to acuminate, bright yellow, ± 1 mm broad; **Anth** reddish; **NSc** broadly oblong to square; **Sty** slender, to 1.2 mm; **Fr** widely spreading, brownish; **Se** probably reticulate-papillose.

Fu & Fu (1984) included *S. parvisepalum* in the synonymy of *S. microsepalum*.

S. parvisepalum ssp. **parvisepalum** – **D:** Taiwan.

[1] **L** linear-oblancoate; flowering **Br** to 25 cm; **Pet** to 7.5 mm.

S. parvisepalum ssp. **philippinense** H. Ohba (J. Jap. Bot. 52(11): 323-324, 1977). **T:** Philippines, Luzon (*Merrill* 4861 [PNH, BO]). – **D:** Philippines (Luzon: Benguet Prov.); rocks on steep slopes, 300 - 1700 m.

Incl. *Sedum australe* van Steenis (s.a.) (*nom. illeg.*, Art. 53.1).

[1] Differs from ssp. *parvisepalum*: **L** narrowly obovate to oblanceolate; flowering **Br** to 15 cm; **Pet** 5 - 6.5 mm.

S. parvum Hemsley (Diagn. Pl. Nov. Mexic. 3:

50-51, 1878). **T:** Mexico, San Luis Potosí (*Parry & Palmer* 234 [K, GH]). – **Lit:** Nesom & Turner (1996). **D:** Mexico (San Luis Potosí); rock outcrops or ledges, 2000 - 2700 m.

≡ *Altamiranoa parva* (Hemsley) Rose (1903) ≡ *Villadia parva* (Hemsley) H. Jacobsen (1958).

[1] Small perennial tufted herbs from creeping rhizomes, much branched, 3 - 5 cm tall; stems green, smooth, with a reddish sheen below; **L** evenly sized and spaced, alternate, oblong and very flat, obtuse, shortly spurred, mamillate towards the tip, 4 - 8 × 2 - 4 mm, suberect, green; flowering **Br** erect, stout; **Inf** few-flowered cymes; **Bra** lanceolate, obtuse; **Fl** 5-merous, subsessile; **Sep** broadly sessile, unequal, lanceolate, obtuse, mamillate at the tip, ± 2.5 mm; **Pet** nearly free to the base, lanceolate, obtuse, narrowly mucronate, erect, 4 - 5 mm, yellow; **NSc** stipitate-spatulate, very broad above, slightly emarginate, yellow; **Fr** slightly spreading; **Se** echinate. – **Cytology:** 2n = 64, 68, ± 120, 128. – [H. 't Hart, B. Bleij & U. Eggli]

S. pedicellatum Boissier & Reuter (Diagn. Pl. Nov. Hisp. 10, 1842). **T** [lecto]: Spain (*Reuter* s.n. [G-BOIS]). – **D:** C Spain, N Portugal; mountains, gravelly places. **I:** Castroviejo (1997: 138, t. 38: e-h).

≡ *Sedum villosum* ssp. *pedicellatum* (Boissier & Reuter) Rivas-Martínez (1963) ≡ *Oreosedum pedicellatum* (Boissier & Reuter) Grulich (1984); **incl.** *Sedum pedicellatum* var. *lusitanicum* Willkomm ex Mariz (1888) ≡ *Sedum pedicellatum* ssp. *lusitanicum* (Willkomm ex Mariz) Lainz (1968) ≡ *Oreosedum pedicellatum* ssp. *lusitanicum* (Willkomm ex Mariz) Velayos (1989); **incl.** *Sedum willkommianum* R. Fernandes (1960).

[1] Glabrous annual or biennial herbs with erect or ascending often much-branched stems to 8 (-12) cm tall, glaucous or pruinose; **L** alternate, sessile, terete to subterete, oblong to ovate, 2.5 - 5.5 × 1.5 - 2.5 mm, rounded or obtuse, glaucous-green, white-farinose or reddish; **Inf** lax cymes with 2 to many cincinni; **Ped** usually slender, 2 - 6.5 mm; **Fl** 5-merous, almost globular in bud; **Sep** broadly sessile, basally connate, ovate to orbicular, 1.5 - 2.5 mm, obtuse; **Pet** free, elliptic, 2.5 - 4 mm, obtuse to acute, white or pinkish, sometimes with slightly erose margins; **Fil** white; **Anth** bright red, rarely yellowish; **NSc** spatulate; **Fr** erect, papillate, brown; **Se** pear-shaped, dark brown, bipapillose. – **Cytology:** 2n = 22, 28.

Closely related to *S. andegavense* and *S. candollei* ('t Hart & al. 1999). The 3 species form a comparium and have been classified in Ser. *Pedicellata*. The smaller, more compact form from the Serra da Estrela (Portugal) may be identical to the Spanish plants with a chromosome number of 2n = 28, but further study is needed.

S. pentapetalum Borissova (in Komarov & al. (eds.), Fl. URSS 9: 90-91, 481, ill. (pl. 5: 1), 1939).

T: Turkmenia (*Borissova* 99 [LE]). – **D:** Turkmenia (Kopet-Dagh), NW Iran, NE Turkey?, Armenia, Azerbaidzhan, Russia (E Caucasus: Dagestan); dry stony and pebbly mountain slopes, 500 - 2000 m, flowers April to May.

[1] Annual erect herbs, unbranched except in the **Inf**, glandulose-pubescent, 5 - 10 (-15) cm; **L** sessile, alternate, elongate-lanceolate, obtuse, 10 - 20 × 1 - 3 mm; flowering **Br** erect; **Inf** corymbose; **Fl** 5-merous, subsessile; **Sep** oblong-triangular, acute, 1 - 2 mm; **Cl** stellate; **Pet** white or pinkish-white, 5 - 7 mm, elongate-lanceolate; **St** shorter than the **Pet**; **Anth** dark violet; **NSc** small, 2- to 3-lobed; **Fr** stellately spreading, 5 - 6 mm, oblong-lanceolate; **Se** ovoid, 0.5 mm, blackish-brown.

Here belongs most of the material identified as *S. hispanicum* by Russian authors. According to the protologue, *S. pentapetalum* differs by its simple, erect stems (vs. branching from the base), 5-merous flowers and larger flowers and fruits. It is also similar to *S. pallidum*, from which it is distinguished by the simple stems and the connate and stellately divergent fruits. – [V. V. Byalt]

S. pentastamineum R. T. Clausen (*Sedum Trans-Mex. Volcanic Belt*, 201-202, ill., 1959). **T:** Mexico, México (*Clausen* 7 [CU]). – **D:** Mexico (México: S-C Trans-Mexican Volcanic Belt); ± 2300 m.

[1] Perennial herbs with repent or pendulous, finely papillose stems; **L** alternate, subopposite or opposite, elliptic, suborbicular or orbicular, rounded, concave dorsally, shortly spurred, papillose marginally, sometimes finely flecked with dark red, 2.1 - 7.9 × 1.2 - 3.6 mm; flowering **Br** pendulous; **Inf** lax cymes; **Ped** 5 - 27 mm; **Fl** 5-merous, with only 5 **St**; **Sep** basally free, shortly spurred, slightly unequal, elliptic, elliptic-oblong or lanceolate, obtuse, 1.3 - 2.4 × 0.7 - 1.4 mm, suberect; **Pet** lanceolate or elliptic-lanceolate, acute, mucronate, pale green to white, ± 3.5 mm, reflexed; **St** 5, episepalous; **Anth** yellow or orange; **NSc** conspicuous, obovately subquadrate, lacinate, dark red or translucent, ± 1 mm. – *Cytology*: 2n = 38.

Closely related to *S. longipes*.

S. perpusillum Hooker *fil.* & Thomson (*J. Proc. Linn. Soc., Bot.* 2: 103, 1858). **T:** K?. – **D:** India, Sikkim; subalpine and alpine regions, ± 3650 m.

[1] Annual or biennial herbs with ascending stems, branched from the base, 2.5 - 5 cm tall; **L** alternate, oblong to obovate, (sub-) acute, ± 5 mm, shortly spurred; **Inf** few-flowered; **Fl** 5-merous, with 5 **St**; **Sep** basally free, shortly spurred, semi-oblong, (sub-) acute, 4 - 5 mm; **Pet** almost free at the base, oblong, narrowed towards the base, white or yellowish, 5 - 6 mm; **NSc** narrowly linear-subspatulate; **Sty** short; **Fr** erect, few-seeded; **Se** reticulate-papillose, with elongate papillae.

S. perrotii Hamet (*Bull. Soc. Bot. France* 71: 154-

157, t. 2, 1924). **T:** China, Gansu (*Potanin* s.n. [LE]). – **D:** China (SW Gansu, SE Qinghai, N Sichuan); thickets in meadows, grasslands, 4000 - 4300 m.

Incl. *Sedum anthoxanthum* Fröderström (1924).

[1] Annual or perennial herbs; **L** alternate, lanceolate to oblong, (sub-) acute, 4 - 8 mm, shortly spurred; flowering **Br** branched from the base, 2 - 6 cm; **Sep** basally free, shortly spurred, oblanceolate to oblong, (sub-) acute, 2 - 4 mm; **Pet** broadly lanceolate to oblong, subobtuse, white or yellowish, 4 - 6.5 mm; **NSc** linear-spatulate, emarginate; **Fr** slender, few-seeded; **Se** long and slender, reticulate-papillose.

S. phyllanthum H. Leveillé & Vaniot (*Bull. Soc. Agric. Sarthe, sér.* 2, 1904: 39, 1904). **T:** China, Guizhou (*Martin & Bodiner* 2406 [E]). – **D:** China (Guizhou); rocky places, 400 - 800 m.

[?] Perennial herbs with numerous diffuse ascending shoots; **L** linear, terete or subterete; **Inf** bracteate cymes; **Bra** large; **Fl** 5-merous; **Sep** oblong; **Pet** shortly apiculate; **Anth** dark (red).

Imperfectly known and as yet inadequately described species. Fu & Ohba (2001: 249) regard the better known *S. quaternatum* (here treated as distinct species) as synonym.

S. piloshanense Fröderström (*Bull. Fan Mem. Inst. Biol.* 7: 13, 1936). **T:** China, Yunnan (*Tsai* 58199 [PE]). – **D:** China (Yunnan); amongst mosses, ± 4000 m.

[1] Probably annual usually tufted herbs with erect to ascending densely leafy stems, simple or branched at the base, 1 - 6 cm tall; **L** alternate, acute, almost clasping at the base, 4 - 5 mm; **Inf** 1- to few-flowered; **Bra** 2 per **Fl**, subopposite, ovate, subacute, 3.5 - 4 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, almost equal, oblong, subacute, 6 - 6.5 mm; **Pet** connate for up to 1 mm, subobovate, subobtuse, yellow, 7 - 7.5 mm; **NSc** linear, slightly broadening towards the tip; **Sty** short; **Fr** erect; **Se** lanceolate, smooth, probably reticulate.

Close to *S. forrestii* and *S. didymocalyx* (incl. *S. froderstromii*), both *Ser. Roborowskii*.

S. pinetorum Brandegee (*Univ. Calif. Publ. Bot.* 6: 358, 1916). **T:** USA, California (*Brandegee* 185499 [UC]). – **D:** SW USA (California). **I:** Fröderström (1936a: 64, t. 38).

≡ *Congdonia pinetorum* (Brandegee) Jepson *ex* Brandegee (1916) (*nom. inval.*, Art. 34.1c).

[1] Small perennial herbs with fleshy fusiform tubers and short tufted stoloniferous sterile stems, forming dense carpets; **L** densely rosulate at the base of flowering **Br**, alternate, oblong, subobtuse, 2 - 3.5 mm; flowering **Br** erect, simple; **Inf** few-flowered; **Bra** suboblong, ± 3 mm; **Fl** 5-merous, sessile; **Sep** broadly sessile, basally free, seemingly broadly spurred, ovate or almost orbicular, obtuse, 2

- 3 mm; **Pet** basally slightly connate, with a very broad base, broadly ovate, broadly apiculate, white, 3.5 - 4.5 mm; **NSc** broader than long, slightly emarginate; **Se** small, subovoid, reticulate-papillose.

Status uncertain; probably identical with *S. niveum* (Clausen 1975).

S. planifolium K. T. Fu (Fl. Tsinling. 1(2): 424-425, fig. 364; Addenda, 606-607, 1974). **T:** China, Gansu (*Fu* 15907 [WUG?]). – **D:** China (Gansu, Shanxi); rocky places to 1600 m.

[1] Perennial herbs with densely leaved ascending non-flowering shoots, branched from the base; **L** decussate, imbricate, with a cuneate basal spur, linear-lanceolate, obtuse, subterete to flattened, with papillate upper margin, 8 - 22 × 2 - 3.5 mm; flowering **Br** to 15 cm; **Inf** many-flowered corymbs with 3 cincinni; **Ped** short; **Fl** 5-merous; **Sep** (broadly) sessile, unequal, linear-lanceolate, obtuse, with papillate upper margin, to 3.8 × ± 0.9 mm; **Pet** almost free, oblong-lanceolate, acute and shortly apiculate, yellow, 7.5 - 7.8 × 1.5 - 1.8 mm; **NSc** semicircular or oblong, with rounded or serrate margin; **Fr** stellately patent; **Se** obovate-oblong, dark brown, densely papillate.

Fu & Fu (1984) considered *S. planifolium* to be close to *S. japonicum*, but it differs by the longer, densely imbricate and flatter leaves, sepals without spur and free petals.

S. platysepalum Franchet (J. Bot. (Morot) 10: 289, 1896). **T:** China, Yunnan (*Delavay* 3706 [P]). – **D:** China (SW Sichuan, NW Yunnan); forest margins, rocks in forests, alpine summits, stony places, 3200 - 4000 m. **I:** Fröderström (1931: 47, t. 28); Byalt (2001a: 32).

[1] Perennial herbs, ± tufted, with creeping stolons and short stems; **L** alternate, subimbricate, lanceolate, acute, broadly spurred, 6 - 10 mm; flowering **Br** erect or spreading, much branched from the base, 8 - 12 cm; **Inf** dense many-flowered corymbs; **Sep** basally free, shortly spurred, oblong to ovate, acute, 6 - 7 mm; **Pet** basally connate for up to 1.2 mm, lanceolate, shortly mucronate, slightly narrowed at the base, yellowish, 8 - 12 mm; **NSc** linear-subspatulate; **Sty** rather short; **Fr** erect; **Se** ovate, reticulate-papillose.

S. platystylum Fröderström (Acta Horti Gothob. 10(Appendix): 38-39, ill., 1936). **T:** Mexico, Jalisco (*Mexia* 1594 [NY]). – **D:** Mexico (Jalisco); ± 2500 m.

≡ *Villadia platystyla* (Fröderström) R. T. Clausen (1959).

[1] Glabrous perennial subshrubs with small sterile shoots; **L** closely set, alternate, oblanceolate to subovate, (sub-) acute, shortly spurred, 10 - 20 mm, on sterile shoots somewhat shorter, spatulate-subovate and mamillate towards the tip; flowering **Br** erect to suberect, simple, 5 - 12 cm; **Inf** small dense

many-flowered corymbs; **Bra** ovate, 3 - 5 mm; **Fl** 5-merous, subsessile; **Sep** basally free, shortly spurred, unequal, suboblong, subobtuse, 3 - 4 mm; **Pet** basally connate, subovate, subobtuse, broadly mucronate, white, ± 5 mm; **NSc** rectangular-subspatulate, thickened and flat at the tip; **Sty** very short and broad; **Fr** turgid; **Se** ovoid, reticulate-papillose.

S. plicatum Thiede & 't Hart (Novon 9: 124, 1999). **T:** Peru, Ancash (*Weberbauer* 3000 [B]). – **D:** Peru (Ancash); 2200 - 2500 m.

Incl. *Cotyledon stricta* Diels (1906) ≡ *Altamiranoa stricta* (Diels) A. Berger (1930); **incl.** *Villadia dielsii* Baehni & Macbride (1937).

[1] Glabrous small perennial subshrubs; main stem erect, branched several times; **Br** strictly erect, 15 - 20 cm, densely leafy; **L** erect, triangular-ovate, semiamplexicaul, 6 - 8 × 1 - 1.5 mm, spurred, spur somewhat hyaline; **Inf** with several cincinni with subsessile **Fl**; **Sep** oblong-ovate, 3.5 × 1.5 mm; **Pet** costate-plicate, excavate at the base, 5 - 8 × 3 mm, margins subundulate, lobes apically recurved; **St** 5 mm; **Ca** 5 - 7 mm; **Sty** 2 - 3 mm.

The transfer of the former *Altamiranoa stricta* to *Sedum* necessitates a new name due to *S. strictum* K. Koch 1847 (referred to *S. cepaea*), and the previously published replacement name *Villadia dielsii* cannot be used because of *S. dielsii* Hamet 1913. – [J. Thiede]

S. polytrichoides Hemsley (JLSB 23: 286, t. 7b, fig. B4, 1887). **T:** China, Zhejiang (*Faber* s.n. [K]). – **D:** E China to Korea (incl. Cheju Do Island) and the Russian border, Japan (Honshu, Kyushu, Shikoku); near the coast and mountain forests at moist rocky places in shade. **I:** Fröderström (1931: 89, t. 55); Fu & Fu (1984: t. 31).

Incl. *Sedum polystichoides* hort. (s.a.) (*nom. inval.*, Art. 61.1); **incl.** *Sedum kiusianum* Makino (1903); **incl.** *Sedum yabeanum* Makino (1903) ≡ *Sedum polytrichoides* var. *yabeanum* (Makino) H. Ohba (2001); **incl.** *Sedum coreense* Nakai (1914); **incl.** *Sedum lepidopodum* Nakai (1940); **incl.** *Sedum yabeanum* var. *setouchiense* Murata & Yuasa (1975) ≡ *Sedum polytrichoides* var. *setouchiense* (Murata & Yuasa) H. Ohba (2001).

[1] Perennial tufted herbs with ascending slender densely leafy stems; **L** alternate, imbricate, linear-lanceolate to oblong, acute, 5 - 15 × 1 - 2 mm; flowering **Br** ascending, slender, branched from the base, more remotely leafy than the sterile stems, 5 - 10 cm; **Inf** corymb-like cymes with 2 - 3 sometimes forked cincinni; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, triangular, subacute to acuminate, 1.5 - 2 mm; **Pet** slightly connate at the base, narrowly lanceolate, acuminate or shortly mucronate, yellow, 5 - 6 mm; **Fil** yellow; **NSc** somewhat fan-shaped to suborbicular or cuneate; **Sty** short; **Fr** substellate, with lips along the sutures; **Se** oblong, reticulate-papillose. – *Cytology*: 2n = 22, 24, 24 -

30, 28, 28 - 40, 30 - 40, 32, 40, 42, 44, 46, 50, 52, 54, 70.

Morphologically and cytologically (Uhl & Moran 1972) a very variable species.

S. yabeanum and its var. *setouchiense* have recently been transferred to *S. polytrichoides* by Ohba (2001: 26-27) and were recognized at the level of subspecies and variety, respectively. – [H. 't Hart, B. Bleij & U. Eggli]

S. pososepalum Fröderström (Acta Horti Gothob. 10(Appendix): 66, ill., t. 37, 1936). **T:** Mexico, San Luis Potosí (*Palmer* 251 [US, GH]). – **D:** Mexico (San Luis Potosí).

[1] Caespitose glabrous perennial herbs, stems short, much branched from the base or **L** axils; **L** alternate, oblong to ovate, obtuse, shortly spurred, mamillate, 4 - 6 mm; flowering **Br** spreading, 2 - 5 cm; **Inf** rather dense many-flowered corymbs; **Bra** oblong, obtuse, 2 - 3 mm; **Fl** 5-merous, subsessile; **Sep** broadly sessile, basally free, unequal, oblanceolate to obovate, rounded to obtuse, ± 3 mm; **Pet** basally free, oblong, subobtusate, ± 4 mm, yellow; **NSc** subquadrate, slightly rounded; **Sty** rather short; **Fr** suberect; **Se** ovoid, reticulate-papillose.

Treated as synonym of *S. parvum* by Nesom & Turner (1996: 261).

S. potosinum Rose (CUSNH 13(9): 300, 1911). **T:** Mexico, San Luis Potosí (*Palmer* s.n. [US 615397]). – **D:** Mexico (San Luis Potosí: Sierra Madre). **I:** Fröderström (1936a: 92, t. 58).

[1] Perennial herbs with low and weak stems, stems at first erect but soon prostrate or at most ascending, 2 - 4 cm; **L** closely set, alternate, ascending, linear to lanceolate, obtuse, nearly terete, broadly spurred, pale glaucous-green, 5 - 8 mm; flowering **Br** erect, slender, to 10 cm; **Inf** lax few-flowered cymes with monochasial **Br**; **Bra** lanceolate; **Ped** 1 - 2 mm; **Fl** 5-merous; **Sep** broadly sessile, basally slightly connate, linear or lanceolate to subovate, obtuse, ± 3 mm; **Pet** basally free, oblong, obtuse, shortly mucronate, white, 6 - 7 mm, widely spreading; **NSc** spatulate-square, deeply emarginate, thick; **Sty** rather short; **Fr** suberect.

S. prasinopetalum Fröderström (Acta Horti Gothob. 15: 20-21, figs. 110-117, t. 6: 1, 1942). **T:** China, Sichuan (*Smith* 11089 [UPS ?]). – **D:** China (S Qinghai, W Sichuan); rocks in thickets, alpine grasslands, 4100 - 4500 m.

[?] Annual or perennial herbs, 3 - 7 cm tall; **L** alternate, suboblong, obtuse, obtuse to sublobate at the base, 3 - 5 mm; flowering **Br** suberect, slender, simple or branched at the base; **Inf** few-flowered corymbs; **Bra** broadly oblanceolate, obtuse, ± 4 mm; **Fl** 5-merous, mostly long-pedicellate; **Sep** basally free, shortly spurred, oblong, obtuse, with distinct almost black veins when dry, ± 3 mm; **Pet** slightly connate at the broad base, subovate, obtuse,

distinctly green when dry, ± 5 mm; **Fil** greenish; **Anth** yellow; **NSc** spatulate with long linear base, obtuse; **Sty** long; **Fr** erect; **Se** obovate, reticulate-papillose.

S. pratoalpinum Fröderström (Acta Horti Gothob. 15: 24, figs. 145-151, 1942). **T:** China (*Smith* 12618 [UPS ?]). – **D:** China (S Qinghai, W Sichuan); alpine meadows, bare places, 4300 - 4600 m.

[1] Small annual herbs, divaricately branched at the base, 2 - 4 cm tall; **L** alternate, oblong, obtuse, shortly spurred, 3 - 5 mm; **Inf** broad many-flowered corymbs; **Bra** broadly lanceolate, 3 - 4 mm; **Fl** 5-merous, usually long-pedicellate; **Sep** broadly sessile, broadly lanceolate, subacute, ± 3 mm, widely spreading; **Pet** slightly connate at the broad base, lanceolate, obtuse, white, ± 4 mm; **NSc** linear-spatulate, obtuse; **Sty** short; **Fr** slightly divergent, few-seeded; **Se** subovoid, reticulate-papillose.

S. pringlei S. Watson (Proc. Amer. Acad. Arts 23: 273, 1887). **T:** Mexico, Chihuahua (*Pringle* 1239 [not located]). – **D:** NW Mexico (Chihuahua).

[1] Perennial herbs with thickened **R**; stems simple below, branched above, erect, to 10 cm tall; **L** alternate, oblong to almost ovate, 5 - 7 mm, obtuse, broadly and bluntly spurred; **Inf** subcorymbose, few-flowered; **Bra** oblong to almost ovate, 3.5 mm; **Fl** 5-merous, 2 - 4 mm pedicellate; **Sep** oblong to ovate, obtuse, 2.5 - 3 mm, spurred; **Pet** $\pm$ oblong, almost completely free, 5 mm, reddish; **NSc** linear-spatulate, somewhat concave, $0.6 - 1 \times 0.25 - 0.3$ mm, reddish; **Ca** basally united, somewhat stellate, 3.5 - 5 mm.

Closely related to *S. napiferum* and *S. minimum*. – [U. Eggli]

S. pruinatum Link *ex* Brotero (Fl. Lusit. 2: 209, 1805). **T:** Portugal, Minho (*Anonymus* s.n. [not located]). – **Lit:** 't Hart (1978). **D:** W Iberian Peninsula (Portugal, Spain).

$\equiv$ *Petrosedum pruinatum* (Brotero) Grulich (1984); **incl.** *Sempervivum pruinatum* Sprengel (1825).

[1] Glabrous perennial herbs, strongly pruinose throughout; non-flowering **Br** procumbent, long and slender, with terminal summer-dormant buds (propagules) with 5 rows of densely imbricate **L**; **L** imbricate, linear, 10 - 19 mm, mucronate, basal spur truncate (not 3-lobed); flowering **Br** erect, 7 - 30 cm; **Inf** terminal lax cymes with 2 - 3 ascending monochasial **Br**, glabrous, erect in bud; **Bra** **L**-like; **Fl** (5- to) 6- (to 7-) merous, subsessile; **Sep** basally connate, equal, triangular-ovate, acuminate, (4-) 5 (-6) mm; **Pet** free, oblong, (pale) yellow, (8-) 9 (-12) mm, spreading; **Fil** yellow, densely papillate at the base; **Anth** yellow; **NSc** transversely oblong, greenish; **Fr** erect, brown; **Se** oblong, truncate, brown, costate. – *Cytology*: $2n = 26$ (plus aneuploids with $2n = 27, 28, 30, 36$).

S. przewalskii Maximowicz (Bull. Acad. Imp. Sci. Saint-Petersbourg 29: 156, 1883). **T:** China, Gansu (*Przewalski* s.n. [LE]). – **D:** Nepal, E Tibet, China (C Gansu, SW Qinghai, W Sichuan, NW Yunnan); dry grassland on high mountain slopes, rocks, 2400 - 5400 m. **I:** Fröderström (1931: 72, t. 38).

[1] Annual or biennial herbs with simple stems or branched from the base, 1.5 - 3 cm tall; **L** broadly lanceolate to ovate, obtuse, 2 - 4 mm; **Inf** few-flowered; **Ped** long; **Fl** 5-merous, with 5 **St**; **Sep** broadly sessile, semi-oblong to semi-ovate, obtuse, 2 - 2.5 mm; **Pet** broadly oblong, obtuse, white or yellowish, 3 - 3.5 mm; **NSc** narrowly linear-subspatulate, obtuse, to 1.5 mm; **Sty** short; **Fr** subdivergent, few-seeded; **Se** reticulate-papillose.

S. pseudo-multicaule H. Ohba (J. Jap. Bot. 53(11): 328-329, 1978). **T:** Nepal (*Namba* 1006040-2 [KYO]). – **D:** Nepal.

[1] Perennial herbs with non-flowering shoots to 20 cm; **L** alternate, opposite or in whorls of 3, rather spaced, narrowly oblanceolate to linear-oblan-ceolate, obtuse to acute, shortly spurred, fleshy but flat, 25 - 40 × 3 - 5 mm; flowering **Br** decumbent, then ascending to suberect; **Inf** lax many-flowered cymes, usually with forked cincinni, primary axes to 4 cm; **Bra** L-like but smaller; **Ped** 2 - 4 mm, mamillate; **Fl** 5-merous; **Sep** basally free, unequal, linear, rounded to obtuse, rather thick, 4.5 - 7 × 0.9 - 1.5 mm; **Pet** basally connate for up to 1.5 mm, yellow, 7.5 - 9 mm, erect; **Anth** yellow; **NSc** narrowly oblong to linear, truncate to rounded; **Sty** to 1.8 mm.

S. pubescens Vahl (Symb. Bot. 2: 52, 1791). **T:** Tunisia (*Vahl* s.n. [C]). – **D:** N Africa (Tunisia, E Algeria).

Incl. *Sedum filiforme* Poiret (s.a.); **incl.** *Sedum hispidum* Desfontaines (1798) ≡ *Oreosedum hispidum* (Desfontaines) Grulich (1984); **incl.** *Sedum atlanticum* Persoon (1805).

[2] Glandular-pubescent somewhat sticky annual herbs with usually simple erect stems to ± 20 cm tall; **L** alternate, sessile, terete or semiterete, oblong to linear-oblong, 6 - 15 mm, obtuse, green, lower face often reddish or purplish; **Inf** lax cymes with 2 to many cincinni; **Bra** small; **Ped** filiform, 3 - 6 mm; **Fl** 5- to 6-merous, ovoid or subglobular in bud; **Sep** broadly sessile, basally connate, ovate-oblong to oblong, 1 - 1.5 mm; **Pet** basally slightly connate, narrowly lanceolate, 5 - 6 mm, acuminate, yellow; **Fil** yellow, glabrous; **Anth** yellow; **NSc** cuneate-square, truncate; **Fr** erect; **Se** ovoid, brown, costate. – *Cytology*: 2n = 12.

Close to *S. gattefossei* and *S. versicolor*. See *S. gattefossei* for further comments.

S. pulchellum Michaux (Fl. Bor.-Amer. 1: 277, 1803). **T:** USA, Tennessee (*Michaux* s.n. [not loca-

ted]). – **Lit:** White & al. (1998). **D:** E USA (predominantly in the drainage of the Mississippi River, on the interior low plateaux and on the Ozark Plateaux); 135 - 470 m. **I:** Fröderström (1936a: 120, t. 75, 81); Clausen (1975: 143).

≡ *Chetyson pulchellum* (Michaux) A. Löve & D. Löve (1985); **incl.** *Sedum linifolium* Nuttall (1818); **incl.** *Sedum pulchrum* De Candolle (1828); **incl.** *Sedum vigilmontis* Small (1933) ≡ *Chetyson vigilmontis* (Small) A. Löve & D. Löve (1985).

[2] Glabrous annual or perennial herbs perennating through the development of persistent, simple or branched, vegetative shoots; **L** alternate, spreading, linear to oblanceolate or spatulate, obtuse to rounded, papillose at the tip (in **Ros**), with 2 sagittate spurs, subterete, 5 - 32 × 1.5 - 5 mm, pale yellow-green; flowering **Br** erect, 6.4 - 23 cm; **Inf** cymes with 3 **Br**; **Fl** 4- (to 7-) merous, sessile or subsessile; **Sep** basally free, unequal, linear-lanceolate, acute or obtuse, light green, 1.3 - 5.8 × 0.5 - 1.5 mm; **Pet** free, narrowly linear-lanceolate or elliptic-lanceolate, acute or obtuse, carinate and slightly channeled, pure white to purple, ± 6 mm, erect or subdivergent; **Fil** white or pinkish; **Anth** red or purple; **NSc** square, truncate and emarginate, white, pinkish white or yellow; **Fr** spreading, smooth or papillose, with lips along the ventral suture, light brown; **Se** elliptically pear-shaped, brown, yellowish brown or pale brown, costate. – *Cytology*: 2n = 22, ± 42.

S. pulvinatum R. T. Clausen (CSJA 20: 36-37, ill., 1948). **T:** Mexico, Oaxaca (*Clausen* C-45-46 [CU]). – **D:** Mexico (Oaxaca).

[1] Glabrous perennial subshrubs, stems procumbent, to 21 cm tall; **L** alternate, oblong-elliptical, prominently spurred, with cushion-like bases, subterete, 5 - 11 × 1.5 - 3 mm, lustrous green; flowering **Br** terminal or axillary; **Fl** solitary, 5-merous; **Sep** basally free, shortly spurred, unequal, lanceolate-oblong, obtuse, 1 - 4 mm, pale green; **Pet** lanceolate, acute, white, 3.5 - 6 mm, widely spreading; **Fil** white; **Anth** yellow; **NSc** square, white; **Fr** and **Se** unknown. – *Cytology*: 2n = ± 108.

S. purdomii W. W. Smith (Notes Roy. Bot. Gard. Edinburgh 9: 126, 1916). **T:** China, Gansu (*Farrer & Purdom* s.n. [E]). – **D:** China (S Gansu); high alpine screes, 3700 - 4000 m. **I:** Fröderström (1931: 73, t. 38).

[1] Annual or biennial (to perennial) herbs with simple stems, sometimes branched from the base, 4.5 - 5.5 cm; **L** alternate, oblong, obtuse, 2 - 4 mm; **Inf** few-flowered; **Ped** 1 - 4 mm; **Fl** 5-merous; **Sep** broadly sessile, broadly linear to oblong, obtuse to rounded, 2 - 3 mm; **Pet** subovate, obtuse to rounded, white or yellowish, 4.5 - 5 mm; **NSc** broadly linear-spatulate, retuse to emarginate; **Sty** short; **Fr** divergent, 2- to 4-seeded; **Se** reticulate-papillose, with long papillae.

S. pusillum Michaux (Fl. Bor.-Amer. 1: 276, 1803). **T:** USA, South Carolina (*Michaux* s.n. [P]). – **D:** E USA (S Appalachian Highlands); granite outcrops in shallow soil, 130 - 170 m. **I:** Clausen (1975: 162).

≡ *Diamorpha pusilla* (Michaux) Nuttall (1818) ≡ *Tetrorum pusillum* (Michaux) Rose (1905); **incl.** *Tillaea cymosa* Nuttall (1818) (*nom. illeg.*, Art. 52.1) ≡ *Diamorpha cymosa* (Nuttall) Britton *ex* Small (1903) ≡ *Sedum cymosum* (Nuttall) Fröderström (1936) (*nom. illeg.*, Art. 53.1).

[2] Small annual herbs with erect finely ribbed stem and extremely long hypocotyl (to 40% of the total height); **L** alternate, elliptic-oblong (ovate or lanceolate), rounded, minutely papillose at the tip, short-spurred, shortly petiolate, 1.6 - 4.3 × 1.1 - 1.8 mm, light green; lower **L** caducous; flowering **Br** erect, simple or branched, 2.3 - 5.8 cm; **Inf** terminal cymes or single **Fl**; **Bra** L-like; **Ped** ± 2 mm, continuous with the **Cal** tube; **Fl** (3- to) 4- (to 7-) merous; **Sep** broadly sessile, broadly ovate to reniform, rounded, ± 0.5 × 1 mm, green; **Pet** free, ovate-elliptic, obtuse, slightly channelled, white, 1.4 - 3.4 mm, divergent; **Fil** white; **Anth** dark red; **NSc** subquadrate, truncate (emarginate), white or pale yellow; **Sty** very short; **Fr** widely divergent, pale brown; **Se** pear-shaped, brown, costate. – *Cytology*: 2n = 8.

S. quadripetalum R. T. Clausen (Bull. Torrey Bot. Club 104(3): 213, 1977). **T:** Mexico, Durango (Clausen 76-29 [CU, ENCB, MEXU, US]). – **D:** Mexico (Durango); ± 2500 m.

[1] Biennial herbs with tuberous **R** and tiny **Ros** with a small subterranean corm; **L** alternate, spatulate, obtuse, petiolate, 17 - 21 × 6 - 8 mm; flowering **Br** erect or ascending, papillose, reddish-brown or greenish, sometimes branched; **Inf** cymes with 3 **Br**; **Fl** 4-merous, long pedicellate; **Sep** basally free, shortly spurred, unequal, clavate-oblancheolate, rounded or truncate, 3 - 4 mm, spreading; **Pet** free, ovate, mucronate, cucullate, reddish, ± 3 mm, first spreading then recurved; **Anth** pale yellow; **NSc** obdeltoid, emarginate, erose, red; **Fr** spreading, with prominent lips along the ventral suture; **Se** pear-shaped, yellowish-brown, reticulate.

S. quaternatum Praeger (Proc. Roy. Irish Acad., Sect. B, 35(1): 6, 1919). **T:** China (*Bailey* Sedum no. 9 [not located]). – **D:** SE China (border region of Hunan, Hubei, Jiangxi); 450 - 750 m. **I:** Fu & Fu (1984: t. 32).

[?] Glabrous perennial herbs; **L** in whorls of 4, narrowly lanceolate, acute; flowering **Br** ascending, rather stout, to 6 cm; **Fl** 5-merous, (sub-) sessile; **Sep** broadly sessile, lanceolate-oblong, unequal, obtuse, almost as long as the **Pet**; **Pet** basally free, lanceolate, shortly mucronate, yellowish, ± 5 mm; **NSc** rectangular-spatulate; **Fr** stellately patent; **Se** reticulate-papillose.

Treated as synonym of *S. phyllanthum* by Fu & Ohba (2001: 249).

S. quevae Hamet (BJS 50(Beiblatt 114): 25-26, 1914). **T:** Mexico, Puebla (*Arsène* 193 [MPU]). – **D:** Mexico (Puebla: SE Trans-Mexican Volcanic Belt); 1900 - 2400 m. **I:** Fröderström (1936a: 31, t. 20); Clausen (1959: 135).

Incl. *Sedum arsenii* Fröderström *in sched.* (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sedum falconis* Brandegee (1919).

[1] Glabrous perennial subshrubs with tuberous **R** and procumbent, much-branched, finely papillose stems with flaking bark, 20 - 40 cm tall; **L** alternate, oblanceolate to elliptic-oblancheolate, spatulate-oblong or subobovate, obtuse, spurred, sometimes finely papillose, 5 - 38 × 3 - 7 mm; flowering **Br** erect, papillose, 7 - 40 cm; **Inf** few-flowered panicles or corymbs; **Bra** subobovate, papillose; **Ped** to 3 mm; **Fl** 5-merous, subsessile; **Sep** basally free, broadly spurred, almost equal, oblong, obtuse, papillose, green, 2 - 7 × 0.8 - 2.4 mm, erect; **Pet** basally slightly connate, triangular-oblong to ovate, acute, shortly mucronate, papillose along the midrib, white, 5 - 7 mm, reflexed; **Anth** red; **NSc** subquadrate or reniform, truncate, slightly emarginate, thick, whitish; **Sty** very long; **Fr** erect, ovoid, turgid, pale brown or reddish-brown; **Se** elliptic-oblong to ovoid, yellow-brown, reticulate. – *Cytology*: 2n = 40, 42.

S. radiatum S. Watson (Proc. Amer. Acad. Arts 18: 193, 1883). **T:** USA, California (*Brewer* 742 [GH]). – **D:** W USA.

≡ *Sedum douglasii* ssp. *radiatum* (S. Watson) R. T. Clausen (1946) ≡ *Sedum stenopetalum* ssp. *radiatum* (S. Watson) R. T. Clausen (1948) ≡ *Amerosedum radiatum* (S. Watson) A. Löve & D. Löve (1985).

[2] Glabrous annual herbs, stems simple or branched, reproducing vegetatively through caducous offsets developing on flowering **Br**; **L** alternate, oblong-elliptic, oblong-lanceolate, lanceolate or ovate, acuminate or acute, glabrous, papillose or ciliate, with short scarious truncately obtuse spurs (unlobed to 3-lobed on flowering **Br**), 4.4 - 14 × 1.8 - 3 mm, somewhat longer and wider on flowering **Br**, yellow-green (**Ros** leaves with 5 green to purple veins); flowering **Br** 5.6 - 19 cm; **Inf** cymes with 3 **Br**, sometimes dichotomously forked; **Ped** to 1 mm; **Fl** 5-merous; **Sep** basally free, broadly spurred, lanceolate or ovate, acuminate or acute, sometimes papillose at the tip, ± 2.5 × 1.5 mm, green to yellow, erect; **Pet** free, elliptic-lanceolate, acute, with a mucronate appendage, carinate, white to yellow, ± 7.5 mm; **Anth** yellow; **NSc** square, truncate, orange or yellow; **Fr** stellate, basally connate, with conspicuous lips along the ventral suture, straw-coloured streaked with reddish brown; **Se** pear-shaped, brown, costate. – *Cytology*: 2n = 16.

S. radiatum ssp. **ciliosum** (Howell) R. T. Clausen (Sedum North Amer., 257-259, ill., 1975). **T:** USA, Oregon (*Howell* 693 [ORE]). – **D:** W USA (Oregon: Klamath Mountains and adjacent Coast Ranges); 220 - 730 m.

≡ *Sedum ciliosum* Howell (1898) ≡ *Sedum douglasii* ssp. *ciliosum* (Howell) R. T. Clausen (1946) ≡ *Sedum stenopetalum* ssp. *ciliosum* (Howell) R. T. Clausen (1948); **incl.** *Sedum ciliatum* Howell (1898) (*nom. illeg.*, Art. 53.1); **incl.** *Amerosedum radiatum* ssp. *ciliosum* A. Löve & D. Löve (1985).

[2] Differs from ssp. *radiatum*: Plants 11 - 22 cm tall; **L** on offsets often ciliate; primary **Br** of **Inf** cymes often dichotomously forked; **Fl** 14 - 17 mm Ø (?); **Pet** 7 - 11 × 2.5 - 3.5 mm, white or creamy-white; **Anth** yellow; **Se** 0.5 - 0.6 mm.

S. radiatum ssp. **depauperatum** R. T. Clausen (Sedum North Amer., 258, 1975). **T:** USA, Oregon (*Clausen* 651-22 [CU]). – **D:** W USA (Oregon, California); forming dense stands; ± 1600 m.

≡ *Amerosedum radiatum* ssp. *depauperatum* (R. T. Clausen) A. Löve & D. Löve (1985).

[2] Differs from ssp. *radiatum*: Plants 3 - 9 cm tall; primary **Br** of **Inf** cymes often dichotomously forked, with more **Fl** per cincinnus than ssp. *ciliatum*; **Fl** 10 - 11 mm Ø (?); **Pet** 6 - 7 × ± 2.5 mm, white or creamy-white; **Anth** red; **NSc** narrower than in ssp. *ciliosum*; **Se** 0.5 - 0.6 mm.

S. radiatum ssp. **radiatum** – **D:** SW USA (California); 150 - 2280 m. **I:** Fröderström (1936a: 106, t. 70); Clausen (1975: 248).

[2] **L** of offsets glabrous, papillose or ciliate; **Inf** simple cinnini with primary **Br** of cymes rarely dichotomously forked; **Pet** yellow; **Se** 0.36 - 0.44 mm.

S. ramentaceum K. T. Fu (Acta Phytotax. Sin. 12(1): 71-72, t. 10: 28-35, 1974). **T:** China, Sichuan (*Fu* 16483 [WUK]). – **D:** China (W Sichuan); rocks along trails on ridges, ± 4500 m. **I:** Fu & Fu (1984: t. 26).

[1] Small biennial herbs, stems sometimes basally branched, to 1.2 cm tall; **L** alternate, linear-oblong to oblanceolate-oblong, obtuse to acute, broadly spurred, yellowish-green, 3.5 - 5.5 × 1.2 - 1.4 mm, basal **L** caducous; **Inf** few-flowered corymbs; **Bra** L-like; **Ped** 1.5 - 3 mm; **Fl** 5-merous, with 5 - 10 **St**; **Sep** spurred, oblong to narrowly ovate, slightly acute, 3 - 4.6 × 1.1 - 1.7 mm; **Pet** basally free, oblong, narrowed to the base, obtuse, yellow, 3.8 - 5 mm; **Anth** yellow; **NSc** linear to subclavate; **Fr** divergent, few-seeded; **Se** oblong, probably reticulate-papillose.

S. raymondii Fröderström (in Handel-Mazzetti, Symb. Sin. 7: 411, 1931). **T:** China, Yunnan (*Handel-Mazzetti* 9720 [W]). – **D:** China (NW Yunnan);

grasslands, rocks on slopes, along trails, pebble beaches, 3200 - 4300 m. **I:** Fröderström (1931: 64, t. 37); Fu & Fu (1984: t. 25).

[1] Annual or biennial herbs with simple rather stout stems, 1.5 - 2.5 cm tall; **L** alternate, broadly oblanceolate to subobovate, subacute, 4 - 9 mm, shortly spurred; **Fl** 5-merous; **Sep** basally free, broadly spurred, unequal, ovate or broader, subacute, 2.2 - 4.5 mm; **Pet** slightly connate at the base, oblong, obtuse, slightly widened at the base, ± unguiculate, white or yellowish, 2.4 - 2.8 mm; **NSc** linear-subspatulate, subacute; **Fr** subdivergent; **Se** reticulate-papillose.

Probably very close to *S. franchetii* and not much more than an ecotype.

S. reniforme (H. Jacobsen) Thiede & 't Hart (Novon 9: 125, 1999). **T:** Peru, Cajamarca (*Weberbauer* 4053 [B]). – **D:** Peru (Cajamarca); 2600 m.

≡ *Villadia reniformis* H. Jacobsen (1958); **incl.** *Cotyledon imbricata* Diels (1906) (*nom. illeg.*, Art. 53.1) ≡ *Villadia imbricata* (Diels) Baehni & Macbride (1937) (*nom. illeg.*, Art. 53.1); **incl.** *Altamiranoa imbricata* A. Berger (1930).

[1] Glabrous perennial herbs; stems much branched at the base, subcaespitose, **Br** sometimes prostrate with erect tips, 5 - 10 cm; **L** closely imbricate, attached with a broad base, broadened-triangular or almost reniform, 2 - 3 × 3 - 4 mm; **Inf** cymose with 2 cincinnoid divaricate-patent **Br**; **Sep** 3 × 1 mm; **Pet** 4 × 1.5 - 2 mm, greenish-white, lobes acute with recurved tip; **St** ± 3.5 mm; **NSc** conspicuous, fleshy, emarginate; **Ca** 2.5 mm.

Easily distinguishable from all other S American *Sedum* (and *Villadia*) species by its reniform leaves, which are broader than long. When transferring *Cotyledon imbricata* to *Sedum*, the epithet of the next younger name for this taxon, *Villadia reniformis*, has to be used because of the earlier *Sedum imbricatum* (Edgeworth) Walpers 1848 (≡ *Rhodiola imbricata*) (Thiede & 't Hart 1999). – [J. Thiede]

S. reptans R. T. Clausen (Bull. Torrey Bot. Club 105(3): 222-223, ill., 1978). **T:** Mexico, San Luis Potosí (*Clausen & al.* 772036 [CU, ENCB, MEXU]). – **Lit:** Nesom & Turner (1996). **D:** Mexico (E San Luis Potosí to Querétaro); forming mats on tops of boulders (limestone) in oak and pine forest, at times also epiphytic, 1700 - 2250 m. **Fig. XXXIX.d**

Incl. *Sedum reptans* ssp. *carinatifolium* R. T. Clausen (1981).

[1] Glabrous perennial herbs with many adventitious **R** and creeping terete stems, youngest parts noticeably papillate; **L** alternate, elliptic-lanceolate, obtuse, subterete, 6.5 - 8.5 × 1.5 - 2.5 mm, spreading; flowering **Br** erect, stout; **Inf** few-flowered cymes; **Bra** lanceolate, obtuse; **Sep** broadly sessile, connate, lanceolate, obtuse, slightly papillose at the tip, ± 2.5 mm; **Pet** lanceolate, narrowly mucronate,

pale yellow, 6 - 8 mm, spreading; **Fr** widely spreading, with lips along the ventral suture, basally connate for $\pm \frac{1}{4}$ of their length; **Se** lanceolate-oblong, reticulate-papillose. – *Cytology*: $2n = 68, 120, 144, 164 \pm 2$.

Similar to *S. tamaulipense* and belonging to the *S. parvum* group (Nesom & Turner 1996). – [H. 't Hart, B. Bleij & U. Eggli]

S. retusum Hemsley (Diagn. Pl. Nov. Mexic. 51, 1880). **T**: Mexico, San Luis Potosí (Parry & Palmer 239 [K]). – **D**: Mexico (San Luis Potosí); 2000 - 2700 m. **I**: Fröderström (1936a: 20, t. 12).

[1] Perennial subshrubs with short basal stem and several erect tuberculately roughened **Br**, 30 - 50 cm tall; **L** broadly spatulate, usually retuse, pseudo-petiolate, shortly spurred, flat, densely mamillate in the upper part, 10 - 17 mm; **Inf** small broad few-flowered corymbs; **Bra** L-like, oblanceolate, mamillate; **Fl** 5-merous, subsessile; **Sep** basally free, broadly spurred, unequal, broadly oblanceolate-spatulate, obtuse, thick, densely mamillate, 2.5 - 5 mm; **Pet** free to the base, lanceolate, subobtuse, submucronate, with slightly narrowed base, carinate, white or reddish, 6 - 6.5 mm; **NSc** spatulate-subquadrate, emarginate, thick; **Fr** erect, sub-oblong; **Se** ovoid, reticulate. – *Cytology*: $2n = 54, 55, 56 - 62$.

S. rhodocarpum Rose (CUSNH 13(9): 300, pl. 59, 1911). **T**: Mexico, Nuevo León (Pringle 10368 [US 462503, ENCB, NY, SJ]). – **D**: Mexico (Tamaulipas, Nuevo León: Sierra Madre Oriental); ± 3000 m. **I**: Fröderström (1936a: 57, t. 36).

[1] Slender glabrous perennial herbs with creeping **Rstock**; sterile stems ± 2 cm long, with the **L** crowded at the tips; **L** in whorls of 3, alternate in the upper part, spatulate-obovate to nearly orbicular, or oblanceolate below the **Inf**, rounded to obtuse, slightly emarginate, shortly spurred, thin, 5 - 30 mm; flowering **Br** ascending, simple, weak, triangular with winged angles, 10 - 20 cm; **Inf** short, few-flowered; **Bra** oblanceolate, obtuse, ± 3.5 mm; **Ped** 2 - 10 mm; **Fl** 5-merous; **Sep** broadly sessile, not or very shortly spurred, unequal, broadly linear to oblanceolate, somewhat cucullate, obtuse, 4 - 5 mm; **Pet** basally connate, broadly ovate, obtuse, shortly mucronate, erose in the upper part, greenish flushed with red, ± 5 mm; **Anth** reddish or purple; **NSc** square, slightly emarginate, flat, white or yellowish; **Sty** short; **Fr** suberect, turgid, deep red; **Se** subovoid, reticulate-papillose. – *Cytology*: $2n = 68, 124, 128$.

S. edwardsii is closely related.

S. robertsonianum Alexander (Bull. Torrey Bot. Club 43: 201, 1936). **T**: USA, Texas (Davis s.n. [NY]). – **D**: USA (Texas: Brewster County), adjacent Mexico (Coahuila); shallow calcareous soil, ± 1300 m. **Fig. XXXIX.h**

$\equiv$ *Sedum palmeri* ssp. *robertsonianum* (Alexander) R. T. Clausen (1981).

[1] Glabrous perennial herbs with caespitose fleshy stems, branched at the base, with numerous decumbent branchlets 8 - 12 cm long; **L** alternate, ovoid, apiculate, appearing minutely papillose (caused by reflection of the inner facets of windowed cells), turgid, 5 - 8 mm, 3 - 4 mm wide and thick, yellow-green; flowering **Br** erect, axillary; **Inf** cymes, simple or with 2 **Br**, sometimes with short **Br** at the base with solitary **Fl**; **Bra** L-like but much smaller; **Fl** 5- (rarely 4-) merous, sessile or subsessile; **Sep** unequal, the 2 outer much larger than the inner, lanceolate, ± 2 mm; **Pet** lanceolate, canaliculate, ± 4 mm, bright yellow. – *Cytology*: $2n = 28$.

Probably part of the *S. parvum* complex and included in the synonymy of the species by some authors (Nesom & Turner 1996).

S. roborowskii Maximowicz (Bull. Acad. Imp. Sci. Saint-Petersbourg 29: 154, 1883). **T**: China, Gansu (Przewalski 791 [LE]). – **D**: Nepal, S Tibet, China (C Gansu, C Ningxia, Qinghai); forested slopes, shady rocks, alluvial banks, 2200 - 4500 m. **I**: Fröderström (1931: 67, t. 39); Fu & Fu (1984: t. 23).

Incl. *Sedum incanum* Prain ex Hamet (1929) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum roborowskii* var. *genuinum* Hamet (1929) (*nom. inval.*, Art. 24.3).

[1] Annual or biennial herbs, branched from the base, 3 - 5 cm tall; **L** alternate, broadly lanceolate to ovate, obtuse, abruptly apiculate, 4 - 7.5 mm, shortly spurred, tip mamillate; **Fl** 5- (to 6-) merous, (sub-) sessile, with 5 - 12 **St**; **Sep** basally free, broadly spurred, unequal, oblong to ovate, obtuse, ± 2 mm; **Pet** oblong, shortly mucronate, white or yellowish, 3 - 4.5 mm; **NSc** broadly linear-spatulate, emarginate; **Sty** short; **Fr** erect; **Se** reticulate-papillose.

S. rosthornianum Diels (BJS 29: 361-362, 1900). **T**: China, Sichuan (von Rosthorn s.n. [O]). – **D**: China (Sichuan - Hubei frontier); grassland slopes, ± 1500 m. **I**: Fröderström (1931: 36, t. 20); Fu & Fu (1984: t. 19).

[1] Probably perennial herbs; **L** in whorls of 3 - 4, oblong, subobtuse, petiolate, denticulate, 70 - 90 mm; flowering **Br** simple, 20 - 25 cm; **Inf** lax rather few-flowered thyrses; **Ped** 6 - 14 mm; **Fl** 5-merous; **Sep** broadly sessile, triangular, subacute, 1.5 - 2 mm; **Pet** basally connate, broadly oblong, subobtuse, white or reddish, 3 - 3.5 mm; **NSc** broadly spatulate; **Sty** short; **Fr** erect, dorsally papillose; **Se** ovate, smooth, probably reticulate.

Denticulate leaves are atypical for the genus *Sedum*, but characterize subtribe *Telephiinae* (*Hylo-telephium*, *Phedimus*, *Rhodiola*). As already suggested in the protologue, the taxon might belong into this group.

S. rosulato-bulbosum Koidzumi (Acta Phytotax. Geobot. 7: 192, 1938). – **D:** Japan (Hachiojima and Amamioshima Islands), Korea.

[1] Perennial or annual herbs with axillary many-leaved bulbils and decumbent to ascending tufted stems, often branched in the upper part, 6 - 20 cm tall; **L** alternate, obovate, obtuse, spurred, sometimes with irregular margins, fleshy but flat, ± 10 mm; **Inf** cymes with 1 - 3 cincinni, these sometimes forked; **Bra** L-like; **Fl** 5-merous, (sub-) sessile; **Sep** basally free, shortly spurred, unequal, oblong to obovate-oblong, obtuse, mamillate, fleshy, 2 - 6 $\times$ 0.5 - 2 mm, suberect; **Pet** lanceolate, shortly and narrowly mucronate, yellow, 3.5 - 5 mm; **Fil** yellow; **Anth** orange-yellow; **NSc** spatulate, white to yellowish; **Sty** ± 1 mm; **Fr** stellately spreading, very broad. – *Cytology*: $2n = 38, \pm 56$.

Very close to and probably identical with *S. bulbiferum* (Ohwi 1965: 497).

S. rubens Linné (Spec. Pl. [ed. 1], 432, 1753). **T:** UPS [lecto: Herb. Burser vol. 16(1): 62]. – **Lit:** Jalas & al. (1999: 94). **D:** Near East, S, C and W Europe, N Africa, Canary Islands (probably introduced). **Fig. XXXIX.f**

$\equiv$ *Crassula rubens* (Linné) Linné (1759) $\equiv$ *Aithales rubens* (Linné) Webb & Berthelot (1840); **incl.** *Sedum boissierianum* Haussknecht in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sedum pallens* Haworth (1821); **incl.** *Sedum rubens* De Candolle (1828) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum matrense* Kitaibel (1863) $\equiv$ *Sedum hispanicum* fa. *matrense* (Kitaibel) Jávorka (1924); **incl.** *Procrassula mediterranea* Jordan & Fourreau (1866) $\equiv$ *Sedum rubens* var. *mediterraneum* (Jordan & Fourreau) Rouy & Camus (1901); **incl.** *Procrassula pallidiflora* Jordan & Fourreau (1866) $\equiv$ *Sedum rubens* var. *pallidiflorum* (Jordan & Fourreau) Rouy & Camus (1901); **incl.** *Sedum simplex* Steudel ex Boissier (1872); **incl.** *Sedum steudelii* Boissier (1872); **incl.** *Sedum ibicense* Pau (1900); **incl.** *Sedum rubens* var. *praegeri* Fröderström (1932); **incl.** *Sedum rubens* var. *haouzense* Andréanszky (1938).

[1] Erect annual herbs, 2 - 15 cm, glandular-pubescent esp. in the upper parts, usually glaucous, reddish; **L** 10 - 20 mm, in whorls of 4, alternate in the upper parts, linear to elliptic, semiterete; **Inf** pubescent bracteate cymes with 2 - 3 or more cincinniform **Br**; **Fl** 5-merous, sessile, with 5 **St** (rarely 5 - 10); **Sep** broadly sessile, basally connate, ± 1 mm, triangular; **Pet** ± 5 mm, usually keeled and sharply acuminate, white, rarely pinkish, usually erect during anthesis; **Fil** as long as the **Ca**, usually papillate at the base; **Anth** small, globose, red or yellowish, usually opening before or at anthesis; **Sty** short; **Fr** brown, divergent from the base and suberect in the upper parts, glandular-pubescent, tuberculate; **Se** ovoid, costate, shiny dark brown to black. – *Cytology*: $2n = 40, 40, 40 - 42, 60, 76, 80, 94, 100, \pm 110$.

Occasionally, gene flow (introgression) may occur between *S. eriocarpum* and *S. rubens* wherever the 2 species occur together, when allopolyploid F2 hybrids are produced.

S. rubrotinctum R. T. Clausen (CSJA 20: 82, ill., 1948). **T:** Mexico (*Clausen* C48-9 [CU]). – **D:** E-C or S Mexico; origin unknown. **Fig. XL.a**

[1] Glabrous perennial subshrubs, 15 cm tall or more; **L** alternate, densely crowded, clavate, terete, turgid, 4 - 21 $\times$ 2 - 8 mm, 2 - 7 mm thick, greenish-red; flowering **Br** erect; **Inf** dense cymes; **Bra** oblanceolate to elliptic, 4 - 7 mm; **Ped** ± 1 mm; **Fl** 5- (rarely 6-) merous; **Sep** unequal, linear-oblong to oblanceolate, obtuse, 3.5 - 5 $\times$ 0.8 - 1.8 mm, greenish-red; **Pet** lanceolate, acute, doubly aristate, $\pm 6.6 \times 2.2$ mm, yellow; **Fil** yellow; **Anth** yellow; **NSc** reniform, broadly rounded.

Possibly of horticultural origin. First recorded as *S. guatemalense* (Clausen 1975: 564).

S. rupestre Linné (Spec. Pl. [ed. 1], 1: 431, 1753). **T:** BM [lecto: Herb. Clifford, p. 177, *Sedum* 4]. – **Lit:** 't Hart (1978). **D:** Europe from Fennoscandia to Sicily and the Balkans to the Pyrenees.

$\equiv$ *Sedum reflexum* var. *rupestre* (Linné) Grenier & Godron (1848) (*nom. inval.*, Art. 25.1, 11.4) $\equiv$ *Petrosedum rupestre* (Linné) P. V. Heath (1987); **incl.** *Sedum nutans* Haworth (1821); **incl.** *Sedum caesium* Boreau apud Pérard (1871); **incl.** *Sedum arrigens* Grenier (1874).

[1] Glabrous perennials; non-flowering **Br** procumbent, rooting, basally often somewhat woody; **L** imbricate, linear to oblong, mucronate, terete, with a truncate spur, 10 - 15 mm, green or glaucous; flowering **Br** ascending, 15 - 35 cm; **Inf** terminal corymbs with 3 - 7 monochasial **Br**, (sub-) globose in bud, **Br** recurved; **Bra** L-like; **Fl** (5- to) 7- (to 9-) merous, (sub-) sessile; **Sep** basally connate, triangular-ovate, acute-acuminate, 3 - 4 mm, glabrous or sparsely glandular-pubescent; **Pet** oblong, yellow, 6 - 7 mm, spreading during anthesis; **Fil** yellow; **Anth** yellow; **NSc** transversely oblong; **Fr** erect, brown; **Se** oblong, brown, costate.

S. rupestre ssp. *erectum* 't Hart (Biosyst. Stud. Gen. *Sedum* 101, 1978). **T:** Italia, Trieste (*Pignatti* s.n. [U 16260]). – **D:** France (French Alps), NW Italy, Slovenia.

$\equiv$ *Petrosedum erectum* ('t Hart) Grulich (1984) $\equiv$ *Petrosedum rupestre* ssp. *erectum* ('t Hart) Velayos (1989); **incl.** *Sedum rupestre* var. *erectum* hort. (s.a.) (*nom. inval.*, Art. 29.1).

[1] Differs from ssp. *rupestre*: **Inf** subglobose and erect in bud, with 4 - 7 (-9) **Br**; **Fil** densely papillose. – *Cytology*: $2n = 64, 96$.

S. rupestre ssp. *rupestre* – **D:** S Fennoscandia (Sweden, Finland) to S Europe (incl. Sicily and the Pyrenees) and N Balkans. **Fig. XXXIX.c**

Incl. *Sedum reflexum* Linné (1755) $\equiv$ *Sedum rupestre* ssp. *reflexum* (Linné) Hegi & Em. Schmid (1922) $\equiv$ *Petrosedum reflexum* (Linné) Grulich (1984) $\equiv$ *Petrosedum rupestre* ssp. *reflexum* (Linné) Velayos (1989); **incl.** *Sedum glaucum* Donn (1804) (*nom. illeg.*, Art. 53.1) $\equiv$ *Sedum reflexum* ssp. *glaucum* (Donn) Janchen (1962); **incl.** *Sedum collinum* Willdenow (1809) $\equiv$ *Sedum reflexum* fa. *collinum* (Willdenow) Rouy & Camus (1901); **incl.** *Sedum cristatum* Schrader (1809); **incl.** *Sedum recurvatum* Willdenow (1809) $\equiv$ *Sedum reflexum* fa. *recurvatum* (Willdenow) Rouy & Camus (1901); **incl.** *Sedum virescens* Willdenow (1809); **incl.** *Sedum albescens* Haworth (1821) $\equiv$ *Sedum rupestre* ssp. *albescens* (Haworth) P. Fournier (1936) $\equiv$ *Sedum reflexum* ssp. *albescens* (Haworth) Rouy & E. G. Camus ex Jovet & R. Vilmoren (1974) (*nom. inval.*, Art. 33.2); **incl.** *Sedum crassicaule* Link (1821); **incl.** *Sedum fragile* Dumortier (1827); **incl.** *Sedum reflexum* var. *viride* Koch (1837); **incl.** *Sedum reflexum* var. *glaucum* Koch (1843) $\equiv$ *Sedum rupestre* var. *glaucum* (Koch) Marchesetti (1897); **incl.** *Sedum graniticum* Pérard (1869); **incl.** *Sedum reflexum* fa. *adpressum* Rouy & Camus (1901); **incl.** *Sedum reflexum* fa. *cristatum* Praeger (1921).

[1] **Inf** with 4 - 6 (-7) **Br**, globose and drooping in bud; **Fil** papillose, rarely smooth. – *Cytology*: $2n = 88, 112, 120$.

This subspecies is an allopolyploid. It evolved through polyploidization from a natural (sterile) hybrid of tetraploid *S. forsterianum* ($2n = 48$) and tetraploid *S. rupestre* ssp. *erectum* ($2n = 64$) some time after the last glaciation. The new subspecies ($2n = 112$) arose somewhere in the W Mediterranean region and being fully fertile, it spread successfully over the whole of W Europe ('t Hart & al. 1993a).

S. rupicola G. N. Jones (Res. Stud. State Coll. Washington 2(4): 125, 1931). **T**: USA, Washington (*Newcomer* 1679 [not located]). – **D**: NW USA (Washington: mainly Wenatchee Mts.); serpentine. **I**: Clausen (1975: 237).

$\equiv$ *Sedum lanceolatum* var. *rupicola* (G. N. Jones) C. L. Hitchcock (1964) $\equiv$ *Amerosedum rupicola* (G. N. Jones) A. Löve & D. Löve (1985).

[2] Perennial tufted herbs with clusters of reddish sterile stems; secondary shoots in the **Ax** of some **L**; **L** easily detaching and serving for vegetative propagation, alternate, ovate, elliptic-ovate or lanceolate, obtuse or apparently acute, $3.2 - 6.2 \times 1.9 - 2.9$ mm, blue-green, purplish or green, sometimes glaucous, divergent, slightly upturned; flowering **Br** erect, ± 18 cm; **Inf** cymes with 3 **Br**; **Bra** narrowly elliptic to linear; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, basally slightly connate, lanceolate or lanceolate-oblong, obtuse or subacute, green, $\pm 3 \times 1.5$ mm; **Pet** free, elliptic-lanceolate or lanceolate, obtuse (rarely acute), minutely mucronate, slightly cucullate, yellow, 6.7 - 8.8 mm, shortly

erect at the base, then widely spreading; **Fil** yellow; **Anth** yellow; **NSc** subquadrate, truncate, yellow; **Fr** erect, basally connate, glabrous, with lips along the ventral suture, brown; **Se** pear-shaped, brown, costate.

Replacing *S. lanceolatum* at higher altitudes in the Wenatchee Mts. and on serpentine.

S. ruwenzoriense Baker *fil.* (JLSB 38: 251, 1908). **T**: Uganda, Toro Distr. (*Wollaston* s.n. [BM]). – **D**: Ethiopia, Kenya, Uganda, Rwanda, Sudan, Zaïre; generally on rocks, 2400 - 4500 m.

Incl. *Sedum ducis-aprutii* Cortesi (1908); **incl.** *Sedum kiwuense* Anonymus in sched. ex Hamet (1929) (*nom. inval.*, Art. 34.1c).

[1] Glabrous perennial herbs with erect or decumbent branched papillose stems to 20 (-30) cm, often distinctly woody at the base; **L** alternate, often densely imbricate, sessile, oblong to oblong-ovoid, $5 - 20 \times \pm 3$ mm, obtuse, semiterete, sometimes papillose, bright green or reddish; **Inf** bracteate cymes or corymbs with 3 - 4 cincinni, these sometimes forked; **Bra** 2 per **Fl**; **Ped** 1 - 4 (-6) mm; **Fl** 5-merous; **Sep** basally free, spurred, 1.5 - 2 mm, obtuse; **Pet** basally connate for 0.2 - 0.4 mm, oblong-lanceolate to oblong, 4 - 6 mm or longer, bright yellow; **Fil** 2.5 - 3 mm, yellow; **Anth** 0.6 - 0.8 mm, yellow; **NSc** oblong-lingulate, shortly re-tuse; **Sty** ± 1 mm; **Fr** many-seeded, erect, pale brown; **Se** ellipsoid, reticulate.

Closely related to *S. meyeri-johannis*. – [H. 't Hart]

S. sagittipetalum Fröderström (Acta Horti Gothob. 15: 15-16, t. 4: 5, 1942). **T**: China, Sichuan (*Smith* 11820 [UPS ?]). – **D**: China (W Sichuan); cliffs; 4300 - 4500 m.

[1] Perennial herbs with numerous tufted stems, 0.5 - 1 cm; **L** alternate, densely imbricate, shortly spurred or obtuse to slightly lobate, broadly oblanceolate, acuminate with divergent tip, bright green or silver-grey when dry, (2-) 4 - 6 mm; flowering **Br** few, 1 - 2 cm; **Inf** 1- or 2-flowered; **Bra** mostly 2 per **Fl**, **L**-like; **Fl** 5- to 7-merous; **Sep** broadly sessile, oblanceolate to oblong, long acuminate, slightly narrowed at the base, 4 - 4.5 mm; **Pet** free at the base, subovate, long apiculate, narrowed towards the tip, narrowly unguiculate almost to the middle, yellow, 6 - 6.5 mm; **NSc** broadly linear, widening towards the tip, slightly emarginate, pale when dry; **Sty** short; **Se** subovoid, smooth, probably reticulate.

S. salvadorensis Standley (J. Washington Acad. Sci. 13: 438, 1923). **T**: El Salvador, Dept. Ahuachapán (*Standley* 20143 [US]). – **D**: El Salvador; rocks in forest. **I**: Fröderström (1936a: 35, t. 23).

[1] Perennial subshrubs, stem erect, simple, very stout, papillose above, ± 14 cm tall; **L** alternate, rather few, oblong, subobtusate, long petiolate, smooth

(young **L** granular-papillose), flat, thin, 2 - 9 cm; flowering **Br** erect; **Inf** dense few-flowered corymbs; **Bra** linear to oblanceolate, smooth or papillose, ± 3 mm; **Ped** $\pm 2 - 3$ mm, slender; **Fl** 5-merous; **Sep** basally free, shortly spurred, unequal, lanceolate to oblong, obtuse, 4 - 5 mm; **Pet** basally slightly connate, subovate, cuspidate-acute, white, ± 5 mm; **NSc** linear-subspatulate, truncate, slightly emarginate; **Sty** 2 - 3 mm; **Fr** suberect.

S. samium Runemark & Greuter (Willdenowia 11(1): 19-20, 1981). **T:** Greece, Samos (Runemark & al. 19333 [LDJ]). – **D:** Greece (E Aegean Islands [Samos]), Turkey (W and S Anatolia); usually on grassy and stony patches on limestone, ± 1000 m.

[1] Erect usually simple annual herbs to 8 cm; **L** oblong-elliptic, subacute, semiterete, with a truncate spur, green or yellowish-green; **Inf** small cymes with 2 - 3 cincinni, rarely with 1 - 3 subsidiary axillary cymes with 1 - 3 **Fl**; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, unequal, subacute; **Pet** lanceolate, acute or mucronate, yellow; **Fil** yellow; **Anth** red or yellow; **Fr** stellately patent, yellowish-brown, with distinct lips along the suture; **Se** ovoid-oblong, ± 1.2 mm, red or orange, reticulate or reticulate-papillose. – *Cytology*: $2n = 18$.

Belonging to the comparium of Ser. *Alpestris* A. Berger but placed in its own monotypic Ser. *Samia* 't Hart ('t Hart 1991). – [H. 't Hart]

S. samium ssp. **micranthum** 't Hart & Alpınar (Willdenowia 21: 150-152, 1991). **T:** Turkey (Alpınar & 't Hart AH60 [ISTE, UJ]). – **D:** Turkey (S Anatolia).

[1] Differs from ssp. *samium*: **Pet** small, to 5 mm, yellow or pale yellow; **Anth** globose, < 1 mm, red or yellow; **Sty** short, ± 0.5 mm.

Differing from ssp. *samium* by its smaller autogamous or pseudocleistogamous flowers. – [H. 't Hart]

S. samium ssp. **samium** – **D:** E Aegean Islands and W Anatolia.

[1] **Pet** ± 7 mm, golden-yellow; **Anth** 1 - 1.5 mm, red, orange or yellow; **Sty** ± 1 mm.

Differing from ssp. *micranthum* by its large allo-gamous flowers. – [H. 't Hart]

S. sarmentosum Bunge (Mém. Acad. Imp. Sci. St.-Petersbourg, Sér. 6, Sci. Math. 2: 104, 1833). **T:** China (Shearer s.n. [K]). – **Lit:** Hsu (1991). **D:** N and C China, Korea, Japan, N Thailand; naturalized C and E Europe (e.g. N Italy, C Germany, Balkans); shady places, rocks etc., below 1600 m. **I:** Fröderström (1931: 86, t. 52).

Incl. *Sedum lineare* var. *contractum* Miquel (1866); **incl.** *Sedum sheareri* S. Moore (1875); **incl.** *Sedum sarmentosum* fa. *maior* Diels (1900); **incl.** *Sedum kouyangense* H. Leveillé & Vaniot (1914).

[1] Perennial herbs with slender creeping and

rooting non-flowering shoots; **L** in whorls of 3, broadly oblanceolate or lanceolate to linear, 10 - 25 mm, subacute, palish yellowish-green; **Inf** bracteate dense cymes or corymbs with 2 - 4 sometimes forked cincinni; **Fl** 5-merous, (sub-) sessile; **Sep** basally free, broadly sessile, often unequal, broadly lanceolate to oblong, 3.5 - 5 mm; **Pet** sometimes slightly connate at the base, lanceolate to oblong, rather long mucronate, yellowish, 5 - 8 mm; **NSc** rectangular-spatulate; **Sty** rather long; **Fr** stellately patent; **Se** reticulate-papillose. – *Cytology*: $2n = \pm 72$.

Fröderström (1936b) distinguished 2 varieties, which, apart from their distribution, seem rather arbitrary and are only tentatively recognized here. *S. angustifolium* and *S. jiuhuashanense* are very similar to *S. sarmentosum* (Hsu 1991).

S. sarmentosum var. **sarmentosum** – **D:** China, Korea, Japan.

[1] Shoots 10 - 25 cm; **L** oblanceolate to oblong, 15 - 25 mm; flowering **Br** ascending, slender; **Inf** many-flowered.

S. sarmentosum var. **silvestre** Fröderström (Bull. Fan Mem. Inst. Biol. 7(1): 14, 1936). – **D:** China (Yunnan).

[1] Differs from var. *sarmentosum*: Shoots to 13 cm; **L** broadly lanceolate, linear in the upper part of flowering **Br**, 10 - 25 mm; flowering **Br** rather stout, 5 - 7 cm; **Inf** few-flowered.

S. satumense Hatusima (J. Geobot. 26(2): 41, 1978). **T:** Japan, Kyushu (Hatusima s.n. [KAG]). – **D:** Japan (Kyushu: Satsuma Peninsula); on rocks, flowers May to June.

[1] Perennial herbs, 5 - 10 cm tall, green without any reddish tinge; flowering **Br** usually branched near the base; **L** opposite, sessile, narrowly ovate or obovate-spatulate, 10 - 22 $\times$ 6 - 9 mm, obtuse, base attenuate; **Inf** corymbiform, $\pm 3 - 4 \times 3$ cm; **Sep** basally slightly connate, free lobes narrowly oblanceolate, 6 - 7 mm, obtuse or rounded; **Pet** yellow, narrowly lanceolate, 7 - 8 mm, acuminate, lower face keeled, ascending at anthesis; **St** slightly shorter than the **Pet**; **Anth** deep yellow; **NSc** square, ± 0.5 mm; **Ca** 4 - 5.5 mm, basally connate for 1 - 1.5 mm, erect at anthesis; **Sty** slender, 1 - 1.5 mm.

Related to *S. formosanum* and *S. nagasakiianum*. It differs from the former by its perennial habit, from the latter by the opposite leaves. *S. makinoi* differs by smaller leaves and flowers with subulate-linear petals.

The specific epithet should presumably be corrected to 'satsumense', but Ohba (2001: 23) continues to use the traditional spelling. – [H. Ohba & U. Eggli]

S. schizolepis Fröderström (Svensk Bot. Tidskr. 29: 385, 1935). **T:** Palestina (*Meynertzhagen* s.n. [not

located]). – **D**: Lebanon, Syria, Palaestina; low altitudes.

[1] Completely glabrous annual herbs; stem simple, erect, slender, 3 - 5 cm; middle **L** linear-lanceolate, 7 - 10 mm, spurred, tip blunt and mamillate; upper **L** broadly lanceolate to obovate, 3.5 - 12 mm; **Inf** laxly scorpioid, few-flowered, surrounded by linear blunt **Bra** 5 mm long; **Fl** 6- to 8-merous; **Sep** triangular-oblong, acute, 2 mm; **Pet** completely free, oblong, 3.5 - 4.5 mm, probably white with red midrib, tip aristate-acute; **NSc** shortly stipitate, spatulate, deeply lobed, 1×0.8 mm; **Ca** shortly fused basally, densely mamillate, 3.5 - 4 mm incl. the long **Sty**.

Compared with *S. hispanicum* in the protologue from which it differs mainly in the deeply lobed nectary scales. – [U. Eggli]

S. scopulinum (Rose) Moran (Haseltonia 4: 46, 1996). **T**: Mexico, Puebla (*Rose* 4996 [US]). – **D**: Mexico (Puebla); rocky hills, 2300 m.

≡ *Altamiranoa scopulina* Rose (1903) ≡ *Villadia scopulina* (Rose) H. Jacobsen (1958).

[1] Glabrous, perennial herbs; stems ± creeping and much-branched, lower parts covered with whitish **Sc** (= bases of old dead **L**); **L** sessile, with a free flap projecting down the stem, closely set but hardly imbricate, linear, almost terete, 4 - 6 mm; **Inf** few-flowered, near the **Br** tips; **Ped** none or short; **Sep** L-like, shorter than the **Pet** and somewhat unequal, **Pet** oblong, acute, almost flat, 5 mm, pure white, basally slightly united; **St** shorter than the **Pet**; **NSc** minute. – [J. Thiede]

S. sediforme (Jacquin) Pau (Actas Mem. Prim. Congr. Nat. Esp. Zaragoza, 246, 1909). – **Lit**: 't Hart (1978). **D**: Mediterranean region from Portugal and Morocco to the Near East (Syria, Israel).

≡ *Sempervivum sediforme* Jacquin (1770) ≡ *Petrosedum sediforme* (Jacquin) Grulich (1984); **incl.** *Sedum altum* Clarke (s.a.); **incl.** *Sedum anophyllum* Chambers (s.a.); **incl.** *Sedum sediforme* var. *congestiflorum* Cámara (s.a.); **incl.** *Sedum nicaeense* Allioni (1785) ≡ *Sedum sediforme* var. *nicæense* (Allioni) Faure & Maire (1931); **incl.** *Sedum aristatum* Villars (1789); **incl.** *Sedum altissimum* Poirlet (1796); **incl.** *Sedum dioicum* Donn (1804); **incl.** *Sedum fruticosum* Brotero (1804); **incl.** *Sedum lusitanicum* Brotero (1816); **incl.** *Sedum jacquinii* Haworth (1825); **incl.** *Sedum soluntinum* Tineo (1845); **incl.** *Sedum salonitanum* Tineo (1845) (*nom. inval.*, Art. 61.1); **incl.** *Sedum sediforme* var. *brevirostratum* Faure & Maire (1931); **incl.** *Sedum sediforme* ssp. *dianium* O. Bolòs (1967) ≡ *Sedum sediforme* var. *dianium* (O. Bolòs) O. Bolòs (1984) ≡ *Sedum nicaeense* ssp. *dianium* (O. Bolòs) S. Rivas-Martínez (1986); **incl.** *Sedum sediforme* var. *saguntinum* O. Bolòs (1975) ≡ *Sedum nicaeense* var. *saguntinum* (O. Bolòs) S. Rivas-Martínez (1986).

[1] Robust glabrous perennial herbs with ascending, often basally woody, non-flowering shoots; **L** imbricate, oblong or elliptic with mucronate tips, semiterete and often somewhat flattened, spurred, to 20 mm, glabrous, dark green and often glaucous; flowering **Br** erect, 25 - 60 cm; **Inf** terminal corymbs with 3 - 8 monochasial **Br**, glabrous, erect and subglobose in bud, with strongly recurved **Br**; **Bra** absent; **Fl** (5- to) 6- to 8- (to 9-) merous, sessile or subsessile; **Sep** basally connate, triangular, equal, mucronate, 2 - 3 mm, glabrous, green; **Pet** free, oblong, greenish-white or cream-coloured, 5 - 8 mm, spreading; **Fil** white, basally papillose; **Anth** yellow; **NSc** transversely oblong; **Fr** erect, dark brown; **Se** oblong, brown, costate. – *Cytology*: $2n = 32, 48, 60, 64, 96$.

S. sedoides (Decaisne) Pau ex Vidal y Lopez (Bol. Real Soc. Esp. Hist. Nat. 21: 277, *tantum quoad basion.*, 1921). **T**: India, Prov. Kanaor (*Jacquemont* 1243 [P?]). – **D**: N India (Himachal Pradesh, N Uttar Pradesh), Kashmir; 2000 - 3000 m. **I**: Eggli (1988: 83, as *Rosularia*).

≡ *Sempervivum sedoides* Decaisne (1844) ≡ *Sempervivella sedoides* (Decaisne) Stapf (1923) ≡ *Rosularia sedoides* (Decaisne) H. Ohba (1977); **incl.** *Sempervivum album* Edgeworth (1846) ≡ *Rosularia alba* (Edgeworth) Stapf (1923) ≡ *Sempervivella alba* (Edgeworth) Stapf (1923) ≡ *Rosularia sedoides* var. *alba* (Edgeworth) P. J. Mitchell (1979); **incl.** *Sedum confertissimum* Falconer ex Hamet (1929) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum jacquemontii* Fröderström (1932) (*nom. illeg.*, Art. 52.1).

[1] Perennial herbs; caudex absent, **R** filiform; **Ros** flattish to semiglobular, 2 - 3.5 cm Ø, freely offsetting with long ± filiform L-less or laxly leafy prostrate runners, soon forming loose cushions; **L** oblong-spatulate to ovoid with rounded tip, 1 - 2 cm, fresh green (ochre-yellowish when dry), densely glandular-hairy and ± viscid, fairly succulent; **Inf** lateral lax panicles, 4- to 12-flowered, 8 - 12 cm, prostrate or erect; **Fl** 6- to 8-merous, saucer-shaped, outer parts glandular-hairy; **Pet** 7 - 8 mm, united for ± 1/3, white with greenish base; **NSc** oblong, apically broadened; **Ca** massive, pale greenish, wholly glandular. – [H. 't Hart & U. Eggli]

S. seelemannii Hamet (J. Bot. 54(Suppl. 1): 21-24, 1916). **T**: India, Kumaon (*Duthie* 2919 p.p. [K]). – **D**: India (Kumaon); ± 4600 m.

[1] Annual or biennial herbs with branched stems 2.5 - 3 cm tall; **L** alternate, linear to oblong, obtuse, 3 - 3.5 mm; **Fl** 5-merous, (sub-) sessile, with 5 **St**; **Sep** broadly sessile, ovate, 2.5 - 3 mm; **Pet** oblong to triangular, subacute, white or yellowish, ± 3 mm; **NSc** narrowly linear, obtuse; **Fr** erect; **Se** reticulate-papillose.

Closely related to and intermediate between *S. duthiei* and *S. magae* (Fröderström 1931: 57-58).

S. sekiteiense Yamamoto (Suppl. Icon. Pl. Formos. 2: 24, 1926). **T:** Taiwan, Taihoku (*Hayata* s.n. [TI]). – **D:** N Taiwan; low-altitude mountains, 200 - 1500 m. **I:** Tang & Huang (1989: 175); Tang & Huang (1993: 32).

[1] Perennial herbs; **L** alternate, crowded on sterile stems, long-spatulate, (sub-) obtuse, narrowing to the petiolate base, 10 - 25 × 4 - 6 mm; flowering **Br** creeping, decumbent below, suberect above, 6 - 12 cm tall; **Inf** cymes with 2 or 3 sometimes forked cincinni; **Fl** 5- (rarely 4-) merous, sessile; **Sep** unequal, spatulate or linear-oblancoale, obtuse, narrowly truncate at the base, 2.8 - 4 × ± 1 mm; **Pet** linear-lanceolate, yellow; **Anth** yellow; **Fr** stellately patent; **Se** yellow.

S. semilunatum K. T. Fu (Acta Phytotax. Sin. 12(1): 67-68, t. 10: 10-18, 1974). **T:** China, Yunnan (Wu & Liu 20189 [KUN]). – **D:** China (W Yunnan).

[1] Small annual herbs with densely leafy simple stems, sometimes 2- or 3-branched at the base, to 1.8 cm tall; **L** alternate, broadly oblanceolate to subobovate, obtuse, broadly spurred, speckled with brown, 3 - 3.5 × 1 - 1.5 mm; **Inf** 1- to 3-flowered; **Bra** 1 - 3, L-like but smaller; **Ped** 2 - 3 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, (sub-) obovate, obtuse, speckled with brown, 2 - 2.5 mm; **Pet** slightly connate at the base, suboblong, somewhat cucullate, yellow, to 5 mm; **Anth** dark grey; **NSc** linear, obtuse to rounded, to 1.5 mm; **Sty** ± 1 mm; **Fr** subdivergent, few-seeded; **Se** narrowly obovate, probably reticulate.

S. semiteres Rose (CUSNH 13(9): 300, 1911). **T:** Mexico, Durango (*Palmer* 180 [US 571200]). – **D:** Mexico (Durango). **I:** Fröderström (1936a: 45, t. 28).

[1] Perennial ± tufted herbs with branched creeping **R**stock and few short sterile stems 2 - 4 cm tall, very leafy; **L** alternate, spreading nearly at right angles to the stem or somewhat drooping, linear to oblanceolate, obtuse, shortly spurred, nearly semiterete, papillose, 5 - 10 mm; flowering **Br** erect or ascending, rather stout, densely papillose, 10 - 20 cm; **Inf** widely spreading cymes, ± papillose; **Ped** 2 - 3 mm, slender; **Fl** 5-merous; **Sep** basally free, broadly spurred, nearly equal, ovate, obtuse, ± 2 mm; **Pet** free to the base, lanceolate, subacute to acuminate, narrowly mucronate, papillose along the midrib, white, ± 5 mm; **Anth** dark-coloured; **NSc** subquadrate-subspatulate, slightly emarginate; **Sty** long and slender; **Fr** widely spreading, papillose along the midrib; **Se** subovoid, reticulate. – *Cytology*: 2n = 38, 108.

S. sexangulare Linné (Spec. Pl. [ed. 1], 430, 1753). **T:** S [neo: Herb. Linné, Fiche 192.3]. – **Lit:** Jalas & al. (1999: 90-91). **D:** Mainly C, S and SE Europe, extending locally to C France, C Italy, SW

former Yugoslavia and the W borders of Russia, doubtfully native to Fennoscandia and very rare in N Greece. **Fig. XL.a**

≡ *Sedum acre* var. *sexangulare* (Linné) Godron (1848); **incl.** *Sedum mite* Gilibert (1782); **incl.** *Sedum boloniense* Loiseleur (1810) ≡ *Sedum sexangulare* var. *boloniense* (Loiseleur) Fenzl (1856) ≡ *Sedum sexangulare* ssp. *boloniense* (Loiseleur) J. A. Huber (1936); **incl.** *Sedum schistosum* Lejeune (1811); **incl.** *Sedum spirale* Haworth (1825); **incl.** *Sedum boloniense* var. *minor* Wirtgen (1857) ≡ *Sedum sexangulare* fa. *minor* (Wirtgen) Soó (1966); **incl.** *Sedum boloniense* var. *parviflorum* R. Uechtritz (1881) ≡ *Sedum sexangulare* fa. *parviflorum* (R. Uechtritz) Soó (1966) (*nom. inval.*, Art. 33.2); **incl.** *Sedum sexangulare* ssp. *montenegrinum* Horák (1898) ≡ *Sedum sexangulare* var. *montenegrinum* (Horák) Hayek (s.a.) ≡ *Sedum montenegrinum* (Horák) R. L. Evans (1983) (*nom. inval.*, Art. 33.2); **incl.** *Sedum tschernokolevii* Stefanoff (1965) (*nom. inval.*, Art. ?).

[1] Laxly caespitose perennial herbs forming mats of rooting and ascending non-flowering shoots; **L** alternate, densely imbricate, on non-flowering shoots usually in 6 rows, cylindrical to linear, spurred, 3 - 6 mm, bright green; flowering **Br** 6 - 15 cm; **Inf** moderately lax cymes with (1-) 2 - 3 (-4) sometimes forked cincinni; **Bra** 2 per **Fl**; **Fl** 5- or rarely 6-merous, subsessile; **Sep** broadly sessile, unequal, linear-elliptic, obtuse; **Pet** 4 - 6 mm, acute or acuminate, bright yellow; **Fil** yellow; **Anth** yellow; **NSc** square; **Sty** long and slender; **Fr** dark brown with narrow brown lips along the suture; **Se** pale brown, reticulate-papillose. – *Cytology*: 2n = 74, 111, 148, 185.

An outlying population in NE Bulgaria has been distinguished as *S. tschernokolevii*, but the differences scarcely justify specific separation. The species is very common in the N and C part of the Balkan Peninsula but rare in the S. It belongs to the comparium of *Ser. Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. shigatsense Fröderström (BMI 1937(2): 97, 1937). **T:** Tibet (*Cutting & Vernay* 62 [K]). – **D:** Tibet; river banks.

[1] Probably annual herbs; **L** alternate, subovate, obtuse to subobtuse, shortly spurred, to 10 mm; flowering **Br** erect, few-branched at the base, to 10 cm, base **L**-less, densely leafy at the tip; **Inf** few-flowered dense cymes; **Bra** oblanceolate, subobtuse, ± 3 mm; **Ped** 3 - 5 mm; **Fl** 5-merous; **Sep** basally free, shortly spurred, unequal, subovate, obtuse, 3 - 3.5 mm; **Pet** slightly connate at the base, subovate, submucronate, yellow, ± 4 mm; **Sty** short.

S. shitaliense Y. Zheng & D. C. Zhang (Bull. Bot. Res., Harbin 20(3): 246-247, ill., 2000). **T:** China, Anhui (*Zheng Yan* 92004 [ANU]). – **D:** China (Anhui); 450 - 560 m.

[1] Perennial evergreen glabrous herbs, 8 - 25 cm tall; **R** fibrous; sterile stems erect, branched towards the tips; **L** alternate (lowermost **L** rarely opposite), massed towards the tips, spatulate-obovate to broadly ovate, 10 - 14 × 11 - 15 mm, basally attenuate and shortly spurred, tip rounded; flowering **Br** erect, **L** alternate, linear, 8 - 14 × 1.7 - 2.5 mm, tip obtuse, base shortly spurred; **Inf** terminal, cymose-scorpoid with 3 several-flowered cincinni, these rarely dichotomously branched, bracteate; **Bra** similar to the stem leaves, 10 - 17 × 2.5 - 5 mm; **Fl** sessile (except the 1 mm pedicellate **Fl** in the centre of the primary branching), 5-merous; **Sep** green, linear, unequal, 2 - 4 × 1 mm; **Pet** oblong-lanceolate, acuminate, 5 × 2 mm, yellow; **Anth** red; **NSc** cuneate, 0.4 × 0.3 mm; **Ca** rarely only 4, ovoid-lanceolate, free to the base; **Fr** divergent, many-seeded; **Se** brown, ovoid-ellipsoid to narrowly ellipsoid, papillose.

Compared with *S. kiangnanense* and *S. emarginatum* in the protologue, and differing from both in the leaf arrangement. Fu & Ohba (2001: 248) rather suggest a closer relationship to *S. alfredii*. – [U. Eggli]

S. sinoglaciale K. T. Fu (Acta Phytotax. Sin. 12(1): 67, 1974). **T:** China, Yunnan (*Delavay* s.n. [P]). – **D:** China (NW Yunnan); thickets in meadows on mountain slopes, 4000 - 4600 m.

Incl. *Sedum glaciale* Franchet (1896) (*nom. illeg.*, Art. 53.1).

[1] Small annual herbs with erect or ascending stems branching from the base, 1.5 - 3 cm tall; **L** linear or linear-oblong, obtuse, spurred, 4 - 7 mm; **Inf** 1- to 3-flowered corymbs; **Bra** L-like; **Ped** 3 - 7 mm; **Fl** 5-merous; **Sep** basally free, with a cuneate or obtuse spur, oblong or linear-oblong, acute, 5 - 7 mm; **Pet** basally connate for 0.5 - 0.8 mm, obovate, obtuse, yellow, 7 - 7.5 mm; **NSc** spatulate, with slightly concave tip, 1 - 1.5 mm; **Sty** 1.8 mm; **Fr** ± 5-seeded; **Se** oblong, reticulate-papillose.

S. smallii (Britton) Ahles (J. Elisha Mitchell Sci. Soc. 80: 172, 1964). **T:** USA, North Carolina (*Small* s.n. [not located]). – **Lit:** Wilbur (1988: as *Diamorpha*). **D:** SE USA (S Piedmont Upland from North Carolina to Alabama); granitic rock flats in vernal pools and depressions. **I:** Clausen (1975: 605, as *Diamorpha cymosa*).

≡ *Diamorpha smallii* Britton (1905) ≡ *Sedum cymosum* var. *smallii* (Rose) Fröderström (1936) (*nom. inval.*, Art. 43.1).

[?] Small annual herbs with hypocotyls ± 6 mm long; stems finely ribbed, appearing striate and red; **L** spreading or appressed, oblong-elliptic or elliptic, 2 - 3 × 1 - 1.8 mm, rounded, smooth or minutely papillose on the margins; **Inf** terminal cymes with 3 - 5 **Fl**; **Bra** similar to normal **L** but smaller; **Fl** (3- to 4- (to 5-) merous, pedicellate, ± 4.7 mm Ø; **Sep** ± 0.6 × 0.6 mm, basally connate, pink but green

below; **Pet** spreading, 4 × 2.4 mm, elliptic, cucullate, white flushed with pink; **NSc** shortly stipitate, reniform, translucent; **Ca** basally connate for ¼ of their length, erect, first white, then pink and finally red; **Fr** widely spreading, brown, opening on the back with the dorsal part falling off; **Se** subglobose-ovoid, yellow-brown, finely longitudinally ribbed.

The confused nomenclature and history of this taxon is outlined by Wilbur (1988). It has been perpetually confused with the sympatrical *Sedum pusillum* Michaux. The carpels are opening with a basal-dorsal tear-shaped flap – a unique character in the family, which led Wilbur to classify it in the monotypic genus *Diamorpha*. – [H. 't Hart, B. Bleij & U. Eggli]

S. somenii Hamet (J. Bot. 54(Suppl. 1): 18-21, 1916). **T:** China, Yunnan (*Maire* s.n. [P, B, TI]). – **D:** China (NW Yunnan); below 2500 m. **I:** Fröderström (1931: 67, t. 40).

≡ *Sedum roborowskii* var. *somenii* (Hamet) Hamet (1929); **incl.** *Sedum mairei* Praeger (1919).

[1] Annual or biennial herbs with suberect curved stems, simple below, branched higher up, 12 - 23 cm long; **L** alternate, oblong to ovate, rounded, with mamillate margins, 3.5 - 7 mm; **Inf** few-flowered dense cymes; **Fl** 5-merous, subsessile, with 5 - 10 **St**; **Sep** broadly sessile, unequal, obovate, rounded, sometimes with mamillate apical margins, 2.5 - 7 mm; **Pet** basally slightly connate, oblong or broadly triangular, subacute, white or yellowish, 3 - 5 mm; **NSc** linear-subspatulate, emarginate; **Sty** short; **Fr** erect; **Se** reticulate-papillose.

S. sorgerae Kit Tan & Chamberlain (Notes Roy. Bot. Gard. Edinburgh 42(1): 65-66, ill. (p. 62), 1984). **T:** Turkey, Van (*Sorger & Buchner* 82-43-199 [E]). – **D:** E Turkey (Van); open vegetation, 1900 - 2200 m; known only from the type collection.

[1] Annual herbs; stems simple or sparingly branched, erect, 12 - 15 cm, glabrous, without sterile **Br**; **L** alternate, oblong-linear, 4.5 - 10 × 0.8 - 1.2 mm, semiterete, fleshy; **Inf** corymbose, 13- to 20-flowered; **Fl** 5-merous, pedicellate; **Sep** united for ½ - ½ of their length, free lobes broadly triangular, 1.8 - 2 × 1.5 - 2 mm, obtuse to somewhat acute; **Pet** narrowly triangular, ± 4 × 1.8 - 2 mm, white with faint pink midvein, acute, longer than the **Sep** lobes; **Fr** oblong, 5 mm, glabrous but verruculose, erect; **Se** pear-shaped, ± 1 mm, pale brown.

According to the protologue without any close allies. *S. confertiflorum* has similarly connate sepals, and 't Hart & Alpınar (2000: 132) treat *S. sorgerae* as synonym of *S. confertiflorum*. – [U. Eggli]

S. spatulifolium Hooker (Fl. Bor.-Amer., 1: 227, 1834). **T:** Canada (*Douglas* s.n. [BM]). – **D:** W Canada, W USA.

≡ *Gormania spathulifolia* (Hooker) A. Löve & D. Löve (1985); **incl.** *Echeveria spathulifolia* De Smet ex Morren (1874).

[2] Glabrous perennial herbs with stout branched rhizomes and procumbent or creeping stems terminating in a **Ros**; **L** alternate, spatulate, rounded or truncate, submucronate, papillose marginally, 7.1 - 19.2 × 4.6 - 9.3 mm, green, often glaucous or pruinose; flowering **Br** erect, 3 - 14 cm; **Inf** cymes with ± 3 **Br**; **Bra** oblong-spatulate or linear, smaller than the **L** of flowering **Br**; **Ped** to 8 mm; **Fl** 5-merous, sweetly fragrant; **Sep** broadly sessile, basally connate, lanceolate, linear-lanceolate, oblong-ovate, or obovate, acute or obtuse, green or yellow-green, glaucous or pruinose, ± 2.5 × 1.5 mm; **Pet** free or slightly basally connate, linear to oblanceolate, acute, yellow, ± 7 mm, basally erect, then widely spreading; **Fil** yellow; **Anth** yellow; **NSc** reniform or nearly square, truncate or sometimes erose, yellow; **Fr** (sub-) divergent, with 5 ribs and prominent lips along the ventral suture, brown; **Se** pear-shaped, yellow-brown, costate. – *Cytology*: 2n = 30.

S. spathulifolium ssp. **pruinsum** (Britton) R. T. Clausen & C. H. Uhl (Madroño 7: 172, 1944). **T**: USA, California (*Eastwood* s.n. [NY]). – **D**: W Canada (Vancouver Island), W USA (to California in the S); just above the high tide level, to 30 m. **I**: Clausen (1975: 466). **Fig. XL.b**

≡ *Sedum pruinsum* Britton (1905) ≡ *Sedum spathulifolium* var. *pruinsum* (Britton) Boivin (1966); **incl.** *Sedum spathulifolium* var. *purpureum* Praeger (1921) ≡ *Sedum spathulifolium* cv. *Purpureum* (s.a.).

[2] Differs from ssp. *spathulifolium*: Very compact, primary **Ros** 1.5 - 2.1 cm Ø; **L** 2.1 - 2.5 mm thick, pruinose; **Fl** 10 - 12 mm Ø.

S. spathulifolium ssp. **purdyi** (Jepson) R. T. Clausen (Sedum North Amer., 468-469, ill., 1975). **T**: USA, California (*Purdy* 2848 [JEPS]). – **D**: W USA (Oregon, N California: N Sierra Nevada and Klamath Mts.); 390 - 1080 m.

≡ *Sedum purdyi* Jepson (1936).

[2] Differs from ssp. *spathulifolium*: Primary **Ros** 2.5 - 3.7 cm Ø, 2 - 4 offsets per **Ros**, stems of offsets 1.2 - 1.6 mm Ø (more slender than in ssp. *yosemitense*) and 1.6 - 4.6 cm long; **L** 1.4 - 2.1 mm thick, closely compacted, green; **Fl** 12 - 16 mm Ø.

S. spathulifolium ssp. **spathulifolium** – **D**: W Canada (British Columbia), W USA (Washington, Oregon, California): Pacific Coast Ranges, to 1590 m. **I**: Fröderström (1936a: 114, t. 76-77); Clausen (1975: 440).

Incl. *Gormania anomala* Britton (1903) ≡ *Cotyledon anomala* (Britton) Fedde (1904) ≡ *Sedum anomalum* (Britton) Britton (1905) ≡ *Sedum spathulifolium* ssp. *anomalum* (Britton) R. T. Clausen

& C. H. Uhl (1944); **incl.** *Sedum californicum* Britton (1903); **incl.** *Sedum woodii* Britton (1905); **incl.** *Sedum spathulifolium* var. *minus* Henderson (1941).

[2] Primary **Ros** 2.5 - 3.7 cm Ø, with 1 - 2 offsets per **Ros**, stems of offsets 1.3 - 1.9 mm Ø; **L** 1.4 - 2.1 mm thick, glaucous; **Fl** 12 - 16 mm Ø.

S. spathulifolium ssp. **yosemitense** (Britton) R. T. Clausen (Sedum North Amer., 467, 1975). **T**: USA, California (*Hall & Babcock* 3425 [US]). – **D**: W USA (California: E slopes of the Sierra Nevada, Klamath Mts. and Transverse Ranges); 430 - 2280 m.

≡ *Sedum yosemitense* Britton (1903); **incl.** *Sedum spathulifolium* var. *majus* Praeger (1921).

[2] Differs from ssp. *spathulifolium*: Primary **Ros** 2.5 - 3.7 cm Ø, with 2 - 4 offsets per **Ros**; stems of offsets 1.4 - 2 mm Ø and 1.9 - 3.4 cm long; **L** not closely compacted, green.

S. spathulisepalum R. T. Clausen (Bull. Torrey Bot. Club 104(3): 213, 1977). **T**: Mexico, Durango (*Clausen* 76-32 [CU, ENCB, MEXU, US]). – **D**: Mexico (Durango); moist cliffs and boulders, ± 2000 m.

[1] Perennial herbs with tiny tuberous **R**, sometimes with tiny axillary **Ros**-producing bulblets; **L** alternate, spatulate, obtuse, petiolate, 5 - 9 × ± 2 mm; flowering **Br** 4 - 10 cm, with tiny **Ros** in the **L**-axils; **Inf** cymes with 3 **Br**; **Fl** 5-merous, with only 5 **St**; **Sep** basally free, shortly spurred, unequal, spatulate, often red-dotted at the scarious base, 3 - 4 mm, spreading; **Pet** free, ovate, mucronate, cucullate, greenish suffused with red, ± 3 mm, first spreading then recurved; **Anth** pale yellow, large, sagittate; **NSc** ovate to square, red; **Fr** spreading, with prominent lips along the ventral suture; **Se** lanceolate, pear-shaped, yellowish-brown, reticulate.

S. stahlii Solms (Sämereien Bot. Gart. Univ. Strasbourg, 1900: 4, 1900). **T**: Mexico, Puebla (*Stahl* s.n. [STR]). – **D**: Mexico (Puebla: NE Sierra Madre del Sur, adjacent Trans-Mexican Volcainc Belt); 1170 - 2440 m. **I**: Fröderström (1936a: 93); Clausen (1975: 182).

[1] Perennial herbs with much-branched, spreading or trailing, puberulent stems; **L** decussate, rarely subopposite or alternate, elliptic-oblong, elliptic or globular, rounded, terete, pubescent, lustrous, suffused with red, 7 - 14 × 4 - 8 mm, detaching very easily; flowering **Br** erect, ± 4 cm; **Inf** cymes usually with 3 **Br**; **Ped** 0.6 - 2 mm; **Fl** 5- (rarely 4- or 6-) merous; **Sep** broadly sessile, unequal, lanceolate, oblong-lanceolate or ovate, acute, pubescent, green, 2.4 - 5.2 × 1.3 - 2.2 mm, erect; **Pet** free, sometimes basally slightly connate, elliptic-lanceolate, acute or acuminate, mucronate, yellow, ± 7 mm, spreading; **Fil** yellow; **Anth** yellow; **NSc** sub-

quadrate, rounded or emarginate, yellow or orange; **Fr** widely divergent; **Se** ovoid, brown, reticulate-papillose. – *Cytology*: $2n = 58$.

S. stefco Stefanoff (God. Sofiisk. Univ., Agro.-Les. Fak. 24(2): 105, 1946). **T**: SOA. – **D**: Former S Yugoslavia, SW Bulgaria, N Greece; dry stony or rocky places in mountains, usually on serpentine, 500 - 1750 m, flowering June to July.

≡ *Oreosedum stefco* (Stefanov) Grulich (1984); **incl.** *Sedum steftscho* Stojanov & Stefanoff (1948) (*nom. inval.*, Art. 61.1?).

[1] Dwarf perennial herbs, glabrous, rhizome decumbent, branching and plants caespitose with 1 - 3 or numerous sterile **Br**; **L** alternate, 4 - 5 × 1.5 mm, elongate-ovoid, cylindrical, acuminate, bright pink to reddish; flowering **Br** (6-) 7 - 10 cm; **Inf** terminal fairly dense cymes with ± 3 **Br**; **Fl** 4-merous, shortly pedicellate; **Pet** 4 - 5 mm, pale pink, lanceolate, acute, suberect to stellately spreading; **St** shorter than the **Pet**; **Sty** very short; **Fr** stellately spreading, basally connate, red; **Se** brown, numerous. – *Cytology*: $2n = 14$.

The spelling of the specific epithet (vs. 'stef-tscho') is in dispute (Springate 2000). – [U. Eggli & V. V. Byalt]

S. stellariifolium Franchet (Nouv. Arch. Mus. Hist. Nat., sér. 2, 7: 10, 1883). – **D**: NW China, Taiwan; montane regions, shady gravelly or rocky places, 400 - 3400 m. **I**: Fröderström (1931: 41, t. 24); Fu & Fu (1984: t. 19); Tang & Huang (1989: 176).

≡ *Sedum drymarioides* var. *stellariifolium* (Franchet) Hamet (1913); **incl.** *Sedum bodinieri* H. Leveillé & Vaniot (1904); **incl.** *Sedum esquirolii* H. Leveillé (1908); **incl.** *Sedum viscosum* Praeger (1921).

[2] Annual or biennial glandular-pubescent herbs with branched somewhat frutescent stems, 10 - 15 cm; **L** alternate, obovate-rhomboid, acute, widely cuneate at the base, petiolate (petioles to 6 mm), 7 - 15 × 5 - 10 mm; **Inf** lax few-flowered cymes; **Ped** 5 - 10 mm; **Fl** 5-merous; **Sep** broadly sessile, lanceolate to oblong, 1 - 2 mm; **Pet** lanceolate-oblong, yellow or pale yellow, 3 - 5 mm; **Sty** short; **NSc** broadly spatulate to widely cuneate; **Fr** erect or subdivergent; **Se** ovoid, brown, costate.

S. stelliforme S. Watson (Proc. Amer. Acad. Arts 20: 365, 1885). **T**: US. – **D**: S USA (Arizona, New Mexico), Mexico (Chihuahua); 1800 - 3260 m. **I**: Fröderström (1936a: 103, t. 67).

[1] Perennial herbs with small fleshy **R**stock and slender stems, branched above, 5 - 12 cm tall; **L** alternate, linear to oblanceolate, obtuse, 4 - 9 mm; flowering **Br** erect or ascending; **Inf** compact cymes with monochasial **Br**; **Bra** suboblong, ± 4 mm; **Fl** 5- to 6-merous, sessile; **Sep** basally free, broadly spurred, unequal, linear to oblong, obtuse, ± 3 mm; **Pet** free to the base, oblong, acute, broadly

mucronate, white tinged with purple, ± 4 mm; **NSc** broader than long, spatulate, emarginate; **Se** ovoid, reticulate-papillose. – *Cytology*: $2n = 22, 24, 29, 44, 48, 52, 108 \pm 2, 120 \pm 4$.

S. stenopetalum Pursh (Fl. Amer. Sept. 1: 324, 1814). **T**: USA, Montana (Lewis & Clark s.n. [PH]). – **D**: W USA.

≡ *Amerosedum stenopetalum* (Pursh) A. Löve & D. Löve (1985); **incl.** *Sedum coerulescens* Haworth (1825); **incl.** *Sedum subclavatum* Haworth (1825).

[2] Glabrous perennial herbs with decumbent branched stems terminating in **Ros**; vegetatively reproducing by means of rosulate offsets on the flowering **Br** and **Inf**; **L** alternate, lanceolate-linear with broad scarious bases or oblong-elliptic with narrower bases, sometimes with papillose margins, subterete, 4.3 - 13.8 × 1.4 - 2.7 mm, green; flowering **Br** erect, branched, 10 - 43 cm; **Inf** cymes, mostly with 3 **Br**; **Bra** smaller than the **L**, linear-lanceolate, acute and spurred; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, lanceolate or ovate, acute or long-acuminate, pale green or yellow-green, 2 - 3.7 × 0.9 - 1.7 mm, erect; **Pet** (3-) 5 (-8), free, lanceolate or elliptic, obtuse, acute or sometimes with an aristate appendage, yellow with green dorsal keel to almost white, 5.4 - 8 mm; **Fil** yellow; **Anth** yellow; **NSc** reniform-subquadrate or square, truncate, greenish-yellow or yellowish-white; **Fr** divergent, finely papillose, shortly connate, with prominent lips along the ventral suture, brown; **Se** pear-shaped, brown or pale yellow, costate. – *Cytology*: $2n = 50 - 54, 58, 59?, 62 - 70, 63 - 64$.

S. stenopetalum ssp. *monanthum* (Suksdorf) R. T. Clausen (*Sedum* North Amer., 276-277, ill., 1975). **T**: USA, Oregon (Howell s.n. [ORE]). – **D**: W USA (Washington to California); 480 - 1970 m.

≡ *Sedum monanthum* Suksdorf (1927) ≡ *Sedum douglasii* var. *monanthum* (Suksdorf) Fröderström (1936) ≡ *Amerosedum stenopetalum* ssp. *monanthum* (Suksdorf) A. Löve & D. Löve (1985); **incl.** *Sedum uniflorum* Howell (1898) (*nom. illeg.*, Art. 53.1) ≡ *Sedum douglasii* var. *uniflorum* (Howell) M. E. Jones (1910) ≡ *Sedum douglasii* fa. *uniflorum* (Howell) G. N. Jones (1936).

[2] Differs from ssp. *stenopetalum*: **L** of the principal vegetative shoots elliptic-oblong, 3 - 4.4× longer than broad; **Inf** solitary terminal **Fl**, sometimes with a vegetative **Ros** instead of the **Fl**.

S. stenopetalum ssp. *stenopetalum* – **D**: W USA (N Washington to N California: Rocky Mountains W-wards); open woods or aspen groves, man-made clearings, 400 - 3050 m. **I**: Clausen (1975: 265). **Fig. XL.c**

Incl. *Sedum douglasii* Hooker (1840).

[2] **L** linear, 4.5 - 13× longer than broad, subulate when dry, with persistent scarious base; **Inf** terminal many-flowered cymes; **Pet** deep yellow.

S. stenophyllum Fröderström (Ark. Bot. 30A(9): 8, 1943). **T:** "Himalaya" (*Jemmett* s.n. [not located]). – **D:** Himalaya.

[1] Perennial herbs with erect stems, 1.5 - 6 cm; **L** alternate, imbricate or subrosulate, linear to spatulate, subacute, (6-) 9 - 12 mm, petiolate, with a broad trilobate spur; flowering **Br** suberect, simple, to 15 cm; **Inf** dense corymbs; **Bra** L-like but smaller; **Fl** 5-merous; **Sep** basally free, broadly spurred, subovate, apiculate, narrowed to the base from the middle, ± 2.5 mm; **Pet** slightly connate at the narrowed base, oblong-lanceolate, shortly mucronate, pale yellow, ± 7 mm; **NSc** spatulate-square, flat at the tip, red; **Fr** stellately patent; **Se** ovoid, red, probably reticulate-papillose.

S. stimulosum K. T. Fu (Acta Phytotax. Sin. 12(1): 57-58, t. 11: 8-16, 1974). **T:** China, Sichuan (*Fu* 16730 [WUK]). – **D:** China (Sichuan). **I:** Fu & Fu (1984: t. 22).

[1] Annual or biennial herbs with erect to prostrate branched glabrous stems 1 - 10 cm tall; **L** alternate, sparse, denser near the **Br**-tips, oblong to obovate-oblong, long mucronate, with a short broadly truncate to slightly trilobate spur, fimbriate at the margins, hirtellous towards the base, 4 - 9.5 $\times$ 1 - 2.5 mm; **Inf** dense few-flowered corymbs; **Bra** similar to the upper **L**; **Fl** 5- to 6-merous, subsessile; **Sep** basally free, spurred, linear-oblong, long mucronate, fimbriate at the margins, hirtellous towards the base, 5.3 - 6 $\times$ 1.3 - 2 mm; **Pet** free, lanceolate, long mucronate, carinate, yellow, ± 7.5 mm; **NSc** spatulate, slightly emarginate; **Sty** long; **Fr** erect, hirtellous, few-seeded; **Se** oblong.

S. suaveolens Kimnach (CSJA 50(1): 3-7, ill., 1978). **T:** Mexico, Durango (*Kimnach & Sánc hez-Mejorada* 1784 [HNT 36252, CAS, MEXU, SD]). – **D:** Mexico (Durango); shaded cliff faces, ± 1150 m.

$\equiv$ *Graptopetalum suaveolens* (Kimnach) R. T. Clausen (1981).

[1] Perennial glabrous caespitose herbs to 50 cm $\varnothing$, stems to 30 mm long, 15 mm $\varnothing$; **L** alternate in lax **Ros** of 10 - 15 cm $\varnothing$, ± 40 , obovate, cuspidate, 50 - 60 $\times$ 30 - 40 mm, flattish but upcurved, upper face slightly concave towards the tip, lower face slightly convex and obscurely carinate, heavily glaucous-waxy, bluish-white, with reddish cusp; flowering **Br** erect, 4 - 7 (-11) cm, glaucous; **Inf** cymes with 3 - 4 **Br**; **Bra** elliptic to slightly obovate, abruptly acute, 12 - 15 mm, shorter on the **Ped**; **Ped** 3 - 7 mm; **Fl** 5-merous, turbinate or urceolate, with faint sweet fragrance; **Sep** unequal, imbricate in bud, oblong, acute, 9 - 12 $\times$ 3 - 5 mm; **Pet** basally free or nearly free, oblanceolate, acute, canaliculate, thin, white, with greenish-yellow midstripe near the tip, 10 - 12 $\times$ ± 4 mm, erect, then spreading and recurved, recurved part somewhat undulate; **Fil** white; **Anth** red, obtusely sagittate; **Sty** ± 2 mm. –

Cytology: $2n = \pm 640$. – [H. 't Hart, B. Bleij & U. Eggli]

S. subgaleatum K. T. Fu (Acta Phytotax. Sin. 12(1): 56-57, t. 11: 1-7, 1974). **T:** China, Yunnan (*Feng* 21299 [KUN]). – **D:** China (Yunnan); rocks, ± 4000 m. **I:** Fu & Fu (1984: t. 21).

$\equiv$ *Sedum susannae* var. *subgaleatum* (K.-T. Fu) K.-T. Fu (1993).

[1] Annual herbs with erect branched tufted stems 4.5 - 7 cm tall; **L** alternate, broadly linear to oblong, subacuminate, 2 - 6.5 $\times$ 1 - 1.5 mm, with a trilobate spur; **Inf** 3- to 5-flowered corymbs; **Bra** similar to the upper **L**; **Ped** 0.5 - 1.5 mm; **Fl** 5-merous; **Sep** broadly sessile, unequal, lanceolate-oblong, subacuminate, 4.5 - 4.8 $\times$ 1.2 - 1.5 mm; **Pet** slightly connate at the base, suboblong, subacute, slightly cucullate, yellow, 4.5 - 5 mm; **NSc** linear-spatulate, widening towards the nearly round emarginate tip; **Fr** erect.

S. subtile Miquel (Ann. Mus. Bot. Lugduno-Batavum 2: 156, 1866). – **D:** China, Japan, Korea, Vietnam; shady moist rocks on low mountains, to 1500 m. **I:** Lee (1998: 273).

[1] Perennial herbs with rather slender shortly creeping stems 4 - 10 cm long; **L** opposite or rarely in whorls of 3 - 5, laxly arranged but subrosulate at the **Br** tips, obovate, rounded to obtuse, narrowed towards the petiole-like base, 5 - 15 (-20) $\times$ (1-) 3 - 5 mm; flowering **Br** with alternate (rarely opposite) **L**; **Inf** laxly flowered cymes with 2 - 3 sometimes forked cincinni; **Bra** linear; **Fl** 5-merous; **Sep** basally free, spurred, narrowly lanceolate to broadly linear, obtuse, 4 - 5 mm; **Pet** lanceolate, thin, yellow, ± 5 mm; **Fr** suberect. – *Cytology:* $2n = 56, 56 - 58, 58 - 60$.

Fröderström (1931: 87, 94) included *S. subtile* partly in *S. alfredii*, partly in *S. lineare*.

S. subtile ssp. *chinense* H. Ohba (J. Jap. Bot. 61(9): 277, 1986). **T:** China, Shanxi (*Smith* 6664 [UPS]). – **D:** China (Jiangsu, Jiangxi, Shanxi); shady moist rocks, 1000 - 1500 m.

[1] Differs from ssp. *subtile*: **L** linear-oblongate, 5 - 15 $\times$ 3 - 5 mm; **NSc** oblong; **Ca** each with 8 - 10 ovules.

S. subtile ssp. *subtile* – **D:** Japan, Korea, Vietnam; mossy rocks in mountain forest. **I:** Makino (1980: 225). **Fig. XL.d**

Incl. *Sedum subtile* var. *caespitosum* Miquel (1866); **incl.** *Sedum subtile* var. *pygmaeum* Miquel (1866).

[1] **L** broadly obovate-spatulate, 5 - 15 mm; **NSc** triangular obovate; **Ca** each with 16 - 18 ovules.

S. subulatum (C. A. Meyer) Boissier (Fl. Orient. 2: 783, 1872). **T:** Azerbaidzhan (*Meyer* s.n. [LE]). – **Lit:** Jalas & al. (1999: 118). **D:** Turkey (Anatolia),

Caucasus (Georgia, Armenia, Azerbaidzhan), Iran, S Russia (near Volgograd); stony open places, 1000 - 2500 m. **I:** Akhiani (2000: 31).

≡ *Cotyledon subulata* C. A. Meyer (1831) ≡ *Umbilicus subulatus* (C. A. Meyer) Ledebour (1843) ≡ *Oreosedum subulatum* (C. A. Meyer) Grulich (1984); **incl.** *Sedum acutifolium* Ledebour (1843); **incl.** *Umbilicus acutifolius* Ledebour (1843); **incl.** *Sedum calvertii* Boissier (1856).

[1] Perennial herbs with thickened **R** forming slender tubers and ascending or trailing and rooting, sometimes tufted, little-branched shoots; **L** alternate, imbricate, sessile, spurred, subulate-linear, 9 - 20 mm, terete, acute or acuminate, dark green or glaucous-green; flowering **Br** erect or ascending, simple, leafy, to 20 cm tall; **Inf** corymbose with 2 - 4 often forked monochasial **Br**; **Bra** small, **L**-like; **Fl** 5-merous, subsessile or shortly pedicellate; **Sep** broadly sessile, basally connate, ovate, ± 2 mm, acute-acuminate; **Pet** basally connate, erect during anthesis, oblong-ovate, 5 - 6 mm, apiculate, white; **Fil** white; **Anth** dark red; **NSc** transversely oblong, irregularly toothed; **Fr** erect, brown; **Se** ovoid, brown, costate. – *Cytology*: 2n = 18.

The closest relative is *S. albertii* (Byalt, pers. comm.). – [H. 't Hart]

S. surculosum Cosson (Bull. Soc. Bot. France 20: 248, 1873). **T:** Morocco (*Ibrahim* s.n. [not located]). – **D:** Morocco; 2400 - 3800 m. **I:** Maire (1977: 316).

≡ *Sempervivum surculosum* (Cosson) Kuntze (1891).

[2] Sparsely glandular-pubescent rosulate perennial herbs with a short thick monopodial stem (or caudex) and numerous short axillary stolons with small rooting terminal **Ros**; **L** alternate, obovate to obovate-oblong or spatulate, semipetiolate or sessile, obtuse or rounded, to 20 mm; flowering **Br** axillary, ascending, to 5 cm long; **Inf** lax few-flowered cymes; **Ped** filiform, to 22 mm; **Fl** 5- to 7-merous; **Sep** broadly sessile, basally connate, ovate, obtuse, ± 2 mm; **Pet** ovate-oblong, obtuse, yellow, ± 3.5 × 2 mm; **Anth** yellow or red; **NSc** conspicuously large, obovate or cuneate; **Fr** erect, brown, few-seeded; **Se** oblong, costate.

S. surculosum is closely related to *S. jaccardianum*. Mes & 't Hart (1994) proposed that *S. surculosum* var. *luteum* (2n = 32) could have evolved from diploid *S. jaccardianum* (2n = 16) through polyploidy, and that *S. surculosum* var. *surculosum* (2n = 30) in turn resulted from var. *luteum* through a descending dysploid change. *S. surculosum*, *S. jaccardianum* and *S. modestum* have been classified in Ser. *Monanthoidea*, which is the sister-group of the "Macaronesian *Sempervivoideae*", i.e. *Aeonium*, *Aichryson* and *Monanthes* (Mes 1995a).

S. surculosum var. *luteum* (Emberger) Maire (Fl. Afr. Nord 14: 317, 1977). – **D:** Morocco (Haut At-

las, Chat Mts., and near Aioui). **I:** CBM t. 5988, 1872, as *Monanthes muralis*; CSJA 74: 29-30, 2002.

≡ *Sedum atlanticum* var. *luteum* Emberger (1936) (*nom. inval.*, Art. 11.4) ≡ *Monanthes atlantica* var. *lutea* (Emberger) H. Jacobsen (1958).

[2] Differs from var. *surculosum*: **Inf** glabrous; **Ped** glabrous; **Pet** yellow; **NSc** yellow, to 0.75 mm long. – *Cytology*: 2n = 32.

S. surculosum var. *surculosum* – **D:** Morocco (Haut Atlas, Anti-Atlas); high altitudes to 3800 m.

Incl. *Monanthes atlantica* J. Ball (1873) ≡ *Sedum atlanticum* (J. Ball) Maire (1924) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum atlanticum* var. *fuscum* Emberger (1936) (*nom. inval.*, Art. 11.4) ≡ *Monanthes atlantica* var. *fusca* (Emberger) H. Jacobsen (1958) ≡ *Sedum surculosum* var. *fusum* (Emberger) Maire (1977).

[2] **Inf** sparsely glandular-pubescent; **Ped** glandular-pubescent; **Pet** yellow tinged red or brownish; **NSc** yellow, to 1 mm long. – *Cytology*: 2n = 30.

S. susannae Hamet (RSN 8: 24-25, 1910). **T:** China, Sichuan (*Wilson* 3636 [P]). – **D:** E Tibet, China (W Sichuan), Myanmar; exposed rocks, stone walls, 2100 - 3800 m. **I:** Fröderström (1931: t. 33).

[1] Perennial herbs with erect or ascending non-flowering shoots; **L** alternate, linear to oblong, acuminate, shortly spurred, 3 - 8.5 mm; flowering **Br** 4 - 12 cm; **Inf** few-flowered cymes; **Ped** to 1 mm; **Fl** 5-merous; **Sep** broadly sessile, slightly unequal, lanceolate, acuminate; **Pet** free almost to the base, suboblong, rather long-mucronate, slightly widening at the base, yellow; **NSc** subquadrate-spatulate, obtuse; **Fr** erect; **Se** obovoid-oblong, probably reticulate-papillose.

S. susannae var. *macrosepalum* K. T. Fu (Acta Phytotax. Sin. 12(1): 57, 1974). **T:** China, Sichuan (*Fu* 16563 [WUK]). – **D:** China (Sichuan); rocks, walls, 3200 - 4370 m.

[1] Differs from var. *susannae*: **Sep** unequal, longer; **Pet** longer and wider.

Fu & Ohba (2001: 228) report the distribution as E Tibet, but the type is from China (Sichuan). – [H. 't Hart, B. Bleij & U. Eggli]

S. susannae var. *susannae* – **D:** China (W Sichuan: Kangding Xian); 1500 - 2600 m. **I:** Fu & Fu (1984: t. 22).

[1] **Sep** 4.5 - 6 mm; **Pet** 5 - 7 mm.

S. tamaulipense G. L. Nesom (Sida 13: 22, 1988). **T:** Mexico, Tamaulipas (*Nesom & al.* 6166 [TEX, BH, MEXU, UAT, WTU]). – **Lit:** Nesom & Turner (1996). **D:** Mexico (C Tamaulipas); tops of large igneous boulders with mosses on oak forest, 1100 - 1250 m.

[1] Glabrous perennial herbs with numerous adventitious **R** and terete prostrate stems, forming

mats, stems smooth, with a sheen; **L** alternate, narrowly oblong, rounded to obtuse, with a prominent spur, terete but drying flattened, $2.5 - 6 (-7) \times \pm 1$ mm, widely spreading; **Inf** cymes with 1 - 3 **Br**; **Ped** 1 - 2 mm; **Fl** 5-merous; **Sep** broadly sessile, connate, ovate, obtuse, $1.2 - 2.2 \times \pm 0.7$ mm; **Pet** triangular, bright yellow, ± 2.5 mm, spreading; **Fr** widely spreading, white, basally connate for $\frac{1}{2} - \frac{3}{5}$ of their length; **Se** brown, reticulate-papillose.

Another member of the *S. parvum* group (Nesom & Turner 1996). – [H. 't Hart, B. Bleij & U. Eggli]

S. tehuaatlense Moran & J. Meyrán (Cact. Suc. Mex. 32(1): 3-7, 24, ill., 1987). **T**: Mexico, México (Otero 76 p.p. [MEXU 407034, CU, HNT, SD]). – **D**: Mexico (México); on rocks between mosses in semishade, ± 2300 m.

[1] Glabrous perennial herbs with short erect stems; **L** alternate, oblong, subacute to acute, acuminate, $15 - 35 \times 5 - 9$ mm; flowering **Br** axillary, 5 - 15 cm; **Inf** cymes with 1 - 2 **Br**; **Bra** similar to the **L** on flowering **Br**; **Fl** 5-merous, subsessile; **Sep** basally slightly connate, unequal in width, oblanceolate, $5 - 7 \times 1.5 - 3$ mm, somewhat ascending; **Pet** basally free, imbricate in bud, lanceolate-cymbiform, acute, canaliculate, yellow, $5 - 7 \times 2.3 - 3$ mm; **Fil** yellowish; **Anth** yellow; **NSc** subquadrate. – *Cytology*: $2n = 64$.

S. tenellum M. von Bieberstein (Fl. Taur.-Caucas. 3: 315-316, 1819). **T**: Georgia (von Bieberstein s.n. [LE]). – **D**: Turkey, Georgia (Caucasus), Iran; rocky places generally above the timber line, 2000 - 3000 m. **Fig. XL.e**

≡ *Oreosedum tenellum* (M. von Bieberstein) Grulich (1984); **incl.** *Sedum farronianum* Kit Tan & Metzger (1992).

[1] Much-branched, sometimes tufted, basally woody perennial herbs; **L** alternate, densely imbricate, sessile with a truncate basal spur, oblong, $3 - 5 \times 1 - 1.5$ mm, obtuse, terete, dark green, glaucous or pruinose; flowering **Br** erect, leafy, to 10 cm tall; **Inf** corymbose cymes with up to ± 4 **Br** and up to 25 **Fl**; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, basally connate, oblong-lanceolate, obtuse; **Pet** ovate or ovate-lanceolate, 3 - 4 mm, apiculate, whitish or sometimes pink or flushed with red; **Fil** white or pink; **Anth** dark red or purplish; **NSc** spatulate tip with emarginate tip, 1 - 2 mm; **Fr** erect, dark brown; **Se** oblong-ovoid, dark brown, costate. – [H. 't Hart]

S. ternatum Michaux (Fl. Bor.-Amer. 1: 277, 1803). **T**: USA (Michaux s.n. [P]). – **D**: E USA (Appalachian Highlands, adjacent Ohio, Arkansas, Missouri, Iowa); deciduous forests, 50 - 1700 m. **I**: Fröderström (1936a: 109, t. 72); Clausen (1975: 93).

≡ *Anacampseros ternata* (Michaux) Haworth (1812) ≡ *Clausenellia ternata* (Michaux) A. Löve &

D. Löve (1985); **incl.** *Sedum americanum* Banks in sched. (s.a.) (nom. inval., Art. 29.1); **incl.** *Sedum portulacoides* Willdenow (1809); **incl.** *Sedum deficiens* Donn (1811); **incl.** *Sedum octogonum* Haworth (1812); **incl.** *Sedum ternatum* var. *minus* Praeger (1921).

[2] Perennial herbs with decumbent finely papillose stems; **L** in whorls of 3 (-4), sometimes decussate, obovate, obovate-spatulate to elliptic, rounded, sometimes emarginate, finely papillose or crenulate, flat ($4 - 30 \times$ wider than thick), truncately short-spurred, $10 - 17 \times 7 - 11$ mm, shortly petiolate or sessile, pale yellow-green to dark green; flowering **Br** erect, 4 - 20 cm; **Inf** cymes with 3 sometimes papillose **Br**; **Ped** papillose; **Fl** 4- (to 6-) merous, sessile or subsessile; **Sep** broadly sessile, basally connate, lanceolate-oblong or elliptic, obtuse, finely papillose, pale yellow-green, $\pm 3.5 \times 1$ mm; **Pet** free, elliptic-lanceolate, acute, ventrally channelled, dorsally carinate, white, $5.4 - 8.9$ mm; **Fil** white, basally flattened; **Anth** red or purple; **NSc** oblong or subquadrate, truncate, yellow or pale yellow; **Fr** widely divergent, with conspicuous pale brown lips along the ventral suture, brown; **Se** elliptically pear-shaped, brown to dark brown, costate. – *Cytology*: $2n = 32$.

S. tetractinum Fröderström (Beih. Bot. Centralbl. 48(2): 311, 1931). **T**: W. – **D**: China (Anhui, Guangdong, Guizhou, Jiangxi); among rocks near streams, 500 - 1000 m. **I**: Fröderström (1931: 103, t. 65); Fu & Fu (1984: t. 30).

[1] Perennial herbs; **L** alternate or in whorls of 3, ovate to orbicular, rounded, mamillate at the tip, long petiolate, 15 - 25 mm; flowering **Br** erect, stout, usually solitary, 9 - 15 cm; **Inf** lax corymbs, long pedunculate; **Bra** orbicular or broader than long, shortly petiolate, mamillate in the upper part, 4 - 5 mm; **Fl** 4-merous, (sub-) sessile; **Sep** broadly sessile, triangular, subacute, ± 0.5 mm; **Pet** free, lanceolate to oblong, $3.5 - 5$ mm; **NSc** subspatulate, widening towards the truncate tip; **Sty** short; **Fr** subdivergent; **Se** ovoid, reticulate-papillose.

Merely differing from *S. triactina* by its 4-merous flowers and broader leaves and bracts.

S. tianmushanense Y. C. Ho & F. Chai (Bull. Bot. Res., Harbin 9(4): 32-35, ill., 1989). **T**: China, Zhejiang (Chai 52 [Herb. Teacher's College Hangzhou]). – **D**: China (NW Zhejiang); moist forests; ± 1000 m.

[1] Perennial herbs with a short **R**stock with oblong globose curved bulbils at the nodes; **L** alternate, linear to linear-lanceolate, obtuse, shortly spurred, $3 - 15 \times \pm 2$ mm; flowering **Br** branched at the base, 5 - 12 cm; **Inf** lax few-flowered cymes with 2 - 7 cincinni; **Bra** linear-lanceolate; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, unequal, obovate-lanceolate, obtuse, $1.5 - 7$ mm; **Pet** basally connate for ± 1 mm, narrowly ovate,

yellow, ± 4 mm; **NSc** square; **Fr** stellately patent; **Se** oblong-lanceolate, pale brown, reticulate-papillose.

S. topsentii Hamet (BJS 50(Beiblatt 114): 26-27, 1914). **T:** USA, Arizona (*Blumer* 2150 [F]). – **D:** USA (Arizona: Chiricahua Mts.); ± 2600 m.

[1] Glabrous perennial herbs with slender erect branched stems, creeping at the base, 8 - 11.5 cm tall, 1 - 2 mm $\varnothing$; **L** alternate, lanceolate, obtuse, 4.5 - 8 mm; flowering **Br** erect; **Inf** compact few-flowered corymbs; **Bra** L-like; **Fl** 5-merous, subsessile; **Sep** basally free, shortly spurred, linear, obtuse, 2.5 - 3.5 $\times$ 0.5 - 1 mm; **Pet** basally slightly connate, suboblong, subobtuse, shortly mucronate, white, ± 7 mm; **NSc** broader than long, slightly emarginate; **Fr** divergent, many-seeded; **Se** ovoid, reticulate-papillose.

S. tortuosum Hemsley (Diagn. Pl. Nov. Mexic. 1: 10, 1878). **T:** Mexico (*Parkinson* s.n. [K]). – **D:** Mexico (Sierra Madre del Sur); epiphytic, mostly on oaks; ± 2500 m. **I:** Clausen (1959: 49).

Incl. *Sedum nelsonii* Rose (1903); **incl.** *Sedum lignicaule* Fröderström (1936).

[1] Perennial subshrubs with ascending finely papillose stems; **L** alternate, oblanceolate or elliptic-spatulate, obtuse, rarely slightly emarginate, minutely spurred, finely papillose at the tip, mostly deciduous, green, 9 - 41 $\times$ 4 - 11 mm; flowering **Br** tortuous, ± 20 cm; **Inf** compound dichasial cymes; **Ped** 2.4 - 4.8 mm, papillose; **Fl** 5-merous; **Sep** minutely spurred, very unequal, oblong, oblong-elliptic, lanceolate or ovate, obtuse or acute, green, 1.7 - 7.7 $\times$ 0.8 - 2.4 mm, spreading; **Pet** basally slightly connate, lanceolate, acute, mucronate, carinate, white with green dorsal keel, ± 7 mm, spreading; **Anth** yellow, sometimes red; **NSc** subquadrate or reniform, pale yellow or creamy-white; **Fr** spreading, with prominent, corky lips along the ventral suture, brown; **Se** brown, linear, 2 - 3 mm, reticulate. – *Cytology*: $2n = 30, 32$.

S. torulosum R. T. Clausen (CSJA 18: 151-152, ill., 1946). **T:** Mexico (*Rush* 18 [CU]). – **D:** Mexico (provenience unknown, probably E Mexican Highlands).

[1] Perennial subshrubs with robust irregularly thickened succulent stems, branching at the base, to 80 cm tall; **L** alternate, closely set to almost rosulate, rhomboidally spatulate, acute, pruinose, 5 - 52 $\times$ 5 - 15 mm; flowering **Br** erect; **Inf** corymbs; **Ped** to 4 mm; **Fl** 5- (rarely 4-) merous; **Sep** basally connate, linear-lanceolate, obtuse, 3 - 4 mm, pale yellowish, widely spreading becoming reflexed; **Pet** elliptic-oblong, minutely apiculate, carinate, erose, pale yellow, 5 - 6 mm; **NSc** oblong, truncate, red; **Sty** long. – *Cytology*: $2n = 68$.

S. tosaense Makino (Bot. Mag. (Tokyo) 15: 35,

1901). – **D:** Japan (Shikoku), China (Zhejiang); on limestone rocks, rare.

[1] Perennial loosely tufted herbs with ascending to decumbent slender fleshy stems ± 12 cm tall; **L** alternate, spatulate, rounded or retuse at the tip, petiolate, with delicate veins; flowering **Br** numerous, ascending; **Inf** cymes with 1 - 3 short spreading 1- to 5-flowered cincinni, these sometimes forked; **Bra** linear-spatulate, obtuse, emarginate; **Fl** 5-merous, (sub-) sessile; **Sep** basally free, spurred, unequal, oblong-linear to linear-spatulate, obtuse; **Pet** slightly connate at the base, oblong-lanceolate, acute, yellow; **NSc** minute, rectangular-spatulate, rounded to truncate, flat; **Sty** short, $\pm$ curved; **Fr** spreading; **Se** probably reticulate-papillose.

Close to *S. tricarpum* and regarded as a rare Japanese endemic by Ohba (2001: 22). The Japanese descriptions are all incomplete in regard of the characters of sepals and seeds, but Fu & Rao (1988: 121) noted that the Chinese specimens have spurred sepals (basally free) and that the seeds are densely lamellate (probably reticulate-papillose). The differences are not very clear, however, and may relate to the phyllotaxis.

S. tosaense ssp. **sinense** K. T. Fu & G. Y. Rao (Acta Bot. Boreal.-Occid. Sin. 8(2): 121-122, ill., 1988). **T:** China, Zhejiang (*He* 22931 [JSBI]). – **D:** China (N Zhejiang).

[1] **L** congested at the **Br** tips, obovate-spatulate, 12 - 20 $\times$ 5 - 10 mm; flowering **Br** with cuneate to linear-spatulate **L** 6 - 10 $\times$ 1 - 2.5 mm; **Pet** mucronate.

S. tosaense ssp. **tosaense** – **D:** Japan (Shikoku). **I:** Makino (1980: 224).

[1] **L** sparse, orbicular-spatulate, to 40 mm, smaller and spatulate towards the **Br** tips; flowering **Br** with cuneate emarginate **L**; **Pet** not mucronate.

S. treleasei Rose (CUSNH 13(9): 300-301, pl. 60, 1911). **T:** Mexico, Puebla (*Rose* s.n. [US 618379]). – **D:** Mexico (Puebla). **I:** Fröderström (1936a: 13, t. 6).

[1] Perennial subshrubs, stems erect, procumbent or pendulous, glaucous, to 20 cm; **L** alternate, crowded, standing nearly at right angles to the stem, oblong to nearly ovate, obtuse, shortly and broadly spurred, thick but flat to slightly subterete, 10 - 35 mm; flowering **Br** axillary, ascending or drooping; **Inf** small compact corymbs; **Fl** 5-merous, subsessile; **Sep** basally free, unequal, linear to oblanceolate, acute to subacute, terete, 3 - 5 mm; **Pet** free to near the base, lanceolate to subovate, obtuse to acute, shortly mucronate, ± 5.5 mm, bright yellow; **Fil** and **Anth** yellow; **NSc** broad, slightly emarginate; **Fr** yellow. – *Cytology*: $2n = 68$.

Fröderström (1936a: 13) describes this species as long pedicellate.

S. triactina A. Berger (NPF2 18a: 460, 1930). **T:** Sikkim (*Hooker* s.n. [K, B]). – **D:** Bhutan, Nepal, Sikkim, Tibet, China.

Incl. *Triactina verticillata* Hooker fil. & Thomson (1858) = *Sedum verticillatum* (Hooker fil. & Thomson) Hamet (1913) (*nom. illeg.*, Art. 53.1).

[1] Perennial or biennial herbs with or without short sterile stems; **L** opposite or whorled, spatulate-oblong, obtuse or slightly retuse, shortly spurred, subpetiolate, flat; flowering **Br** rather weak and fleshy with **L** in whorls of 3; **Inf** lax corymbs, long pedunculate; **Bra** 5 - 10 mm; **Fl** 5-merous, but with only 3 or 4 **Ca**; **Sep** broadly sessile, broadly linear to oblong, ± 1 mm; **Pet** basally connate for up to 1 mm, broadly oblong, subobtuse, very shortly mucronate or emarginate, pale yellowish, 4 - 6.5 mm; **NSc** broadly linear; **Fr** subdivergent, basally connate for ± 2 mm, with small lips along the sutures; **Se** probably reticulate-papillose.

S. triactina ssp. **leptum** Fröderström (Acta Horti Gothob. 15: 28-29, figs. 185-195, 1942). **T:** China, Sichuan (*Smith* 10567 [UPS ?]). – **D:** China (W Sichuan); moist rocks in *Rhododendron* thickets etc., 3200 - 3700 m.

= *Sedum triactina* var. *leptum* (Fröderström) K. T. Fu (1993).

[1] Differs from ssp. *triactina*: Plants less robust, frequently much branched at the base; **L** minutely mamillate at the tip, < 10 mm; flowering **Br** 9 - 14 cm; **NSc** linear-subspatulate; **Ca** 3 (-4), each with 2 - 3 ovules.

S. triactina ssp. **triactina** – **D:** Sikkim, Bhutan, Nepal, E Tibet, China (SW Sichuan, Yunnan); mossy rocks in forests, 2200 - 3600 m. **I:** Fröderström (1931: 110, t. 64); Fu & Fu (1984: t. 30). **Fig. XL.f**

[1] Plants robust; **L** smooth at the tip, 10 - 40 mm; flowering **Br** 7 - 35 cm; **NSc** broadly linear; **Ca** 3, with 1 - 2 ovules.

S. tricarpum Makino (Ill. Fl. Jap. 1(6): 71, 1891). **T:** Japan, Shikoku (*Makino* s.n. [TI]). – **D:** Japan (Honshu, Shikoku, Kyushu); gravelly soils in mountains. **I:** Makino (1980: 225).

Incl. *Sedum tricarpum* fa. *viride* Hatusima (1987).

[1] Perennial herbs with $\pm$ creeping stems; **L** alternate, clustered at the stem tips, more lax further down, spatulate, rounded, flat, fleshy, 20 - 25 $\times$ 5 - 10 mm; flowering **Br** rather stout, 10 - 25 cm; **Inf** lax much-branched cymes; **Bra** oblanceolate or narrowly spatulate; **Fl** 5-merous, but with only 3 - 5 **Ca**; **Sep** linear-spatulate to lanceolate, obtuse; **Pet** basally slightly connate, ascending to spreading, narrowly lanceolate, yellow, 6 - 8 mm, long acuminate; **NSc** widely obovate, ± 5 mm; **Fr** ascending, basally connate; **Se** narrowly oblong-ovoid, minutely tuberculate. – *Cytology*: $n = 62$ (Uhl & Moran 1972).

The description is supplemented from Ohba (2001: 22). – [H. 't Hart, B. Bleij & U. Eggli]

S. trichospermum K. T. Fu (Acta Phytotax. Sin. 12(1): 68-69, t. 12: 1-9, 1974). **T:** China, Sichuan (*Fu* 16544 [WUK]). – **D:** China (W Sichuan); grassy places, 4000 - 4600 m. **I:** Fu & Fu (1984: t. 27).

[?] Annual herbs with erect to ascending few-branched sparsely leafy stems 2.5 - 5 cm tall; **L** alternate, linear to linear-lanceolate, subacute, shortly spurred, 2.5 - 7.1 $\times$ 0.6 - 1.5 mm; **Inf** few- to many-flowered corymbs; **Bra** similar to the upper **L** but smaller; **Ped** 1 - 2.5 mm; **Fl** 5-merous; **Sep** probably basally free, oblong, obtuse, $\pm 3 \times 1$ mm; **Pet** free or slightly connate at the broad base, suboblong, obtuse, somewhat cucullate, yellow, 4 - 4.5 mm; **NSc** linear to sublinear-spatulate, obtuse; **Sty** long; **Fr** subdivergent; **Se** obovate, reticulate-papillose with long almost **Ha**-like papillae.

S. trichromum R. T. Clausen (Bull. Torrey Bot. Club 105(3): 221-222, 1978). **T:** Mexico, Durango (*Clausen* 76-33-1 [CU, ENCB, MEXU]). – **D:** Mexico (Durango); ± 2000 m.

[1] Tufted glabrous perennial herbs with thick white primary **R** and mostly red stems; **L** alternate, elliptic to elliptic-lanceolate, spurred, flat, 10 - 18 $\times$ 6.4 - 7 mm; flowering **Br** erect; **Inf** cymes with 2 - 3 **Br**; **Bra** L-like but smaller; **Fl** 5-merous, with only 5 **St**, pedicellate; **Sep** basally free, shortly spurred, unequal, lanceolate, acute, greenish, 6.5 - 9 mm; **Pet** free to the base, lanceolate, acute, dark purple, with green tip and white base, 7 - 10 $\times$ 3 - 4 mm; **Anth** yellow; **NSc** square, truncate, white to yellowish; **Fr** erect, pale brown; **Se** reticulate or reticulate-papillose. – *Cytology*: $2n = 38$.

S. tristriatum Boissier (Diagn. Pl. Orient. 1(10): 16, 1849). **T:** Greece, Crete (*Heldreich* 1615 [G-BOIS]). – **D:** S Greece, Crete; mountains on limestone, 1700 - 2100 m. **I:** Contandriopoulos & al. (1966: 463, figs. 5-8). **Fig. XL.g**

= *Oreosedum tristriatum* (Boissier) Grulich (1984) = *Helladia tristriata* (Boissier & Heldreich) M. Král (1987).

[1] Perennial herbs, glandular-pubescent; sterile **Br** caespitose, **Ros**-like; **L** of **Ros** oblong-spatulate, flattish; flowering **Br** 2 - 10 cm, ascending, from the **Ax** of the lower **L** of the **Ros**, **L** alternate, obovate, semiterete; **Inf** lax cymes, with groups of 4 - 7 (-15) **Fl**; **Fl** 5- (to 6-) merous; **Sep** 1 - 2 mm, ovate-triangular; **Pet** narrowly ovate-elliptic, pale pink with darker stripes or white, aristate; **Fr** erect, whitish; **Se** longitudinally striate. – *Cytology*: $2n = 22$, 44 (Webb & al. 1993).

Superficially similar to *Prometheum tymphaeum* but placed in *Sedum* Ser. *Cepaea*. Contandriopoulos & al. (1966) report a chromosome number of $2n = 16$. – [U. Eggli]

S. tritelii Hamet (Publ. Field Columbian Mus., Bot. ser. 2: 379, 1913). **T:** Guatemala (*Lehmann* 1528 [G-BOIS]). – **D:** Guatemala (Sierra Madre); on rocks, $\pm$ 400 m.

[1] Glabrous perennial herbs with ascending simple papillose stems, creeping at the base with very short sterile shoots, $\pm$ 3 - 5 cm tall; **L** alternate, suboblong to obovate, subobtuse, 4.5 - 7 mm; flowering **Br** erect; **Inf** 2-flowered; **Bra** L-like but smaller; **Fl** 5-merous, subsessile; **Sep** broadly sessile, linear-deltoid, subobtuse, 4.5 - 5.5 $\times$ $\pm$ 2 mm; **Pet** nearly free to the base, suboblong, subobtuse, yellow, 5.5 - 6.5 mm; **NSc** sublinear, obtuse, slightly dilated at the base; **Sty** $\pm$ 2 mm; **Fr** divergent, few-seeded.

S. trullipetalum Hooker *fil.* & Thomson (J. Proc. Linn. Soc., Bot. 2: 102, 1858). **T:** K. – **D:** Sikkim, Nepal, Tibet, China. **I:** Byalt (2001a: 31).

[1] Perennial herbs with dense tufts of numerous non-flowering stems 1 - 4 cm long; **L** alternate, imbricate, oblong to narrowly triangular, acuminate, 5 - 10 mm, with a trilobate spur; flowering **Br** simple or branched at the base, 4 - 8 cm; **Inf** small rather dense corymbs; **Fl** 5-merous; **Sep** broadly sessile, oblong, 4 - 6.5 mm; **Pet** slightly connate at the base, ovate, submucronate, unguiculate for up to $\frac{1}{2}$ their length, yellowish, 6 - 10 mm; **NSc** rectangular, deeply emarginate; **Sty** to 1 mm; **Fr** erect, basally connate for 2.5 mm; **Se** reticulate-papillose.

S. trullipetalum var. **ciliatum** Fröderström (Acta Horti Gothob. 15: 14-15, figs. 68-74, t. 4: 4, 1942). **T:** China, Xinjiang (*Smith* 11651 [UPS ?]). – **D:** NE Tibet, China (W Sichuan); granitic rocks, $\pm$ 4300 m.

[1] Differs from var. *trullipetalum*: **L** long acuminate, ciliate; **Sep** long acuminate, ciliate; **Anth** acute; **Ca** densely papillose.

S. trullipetalum var. **trullipetalum** – **D:** Sikkim, Nepal, Tibet, China (W Sichuan, NW Yunnan); grassy meadows on alpine summits, rocks and rock crevices, 2700 - 4400 m. **I:** Fröderström (1931: 43, t. 26); Fu & Fu (1984: t. 24). **Fig. XLI.b**

[1] **L** acuminate, not ciliate; **Sep** shortly acuminate, not ciliate; **Anth** obtuse to rounded; **Ca** smooth.

S. tsiangii Fröderström (Sinensia 3(8): 199, 1933). **T:** China, Guizhou (*Tsiang* 9420). – **D:** China (W Guizhou, E Yunnan).

[1] Annual or biennial herbs with ascending branched densely leafy stems; **L** oblanceolate, subobtuse, mamillate towards the tip, 10 - 15 mm; **Inf** lax involucre few-flowered corymbs; **Bra** subobovate; **Fl** 5-merous, shortly pedicellate; **Sep** broadly sessile, linear-lanceolate, subobtuse, mamillate towards the tip, 3 - 4 mm; **Pet** free, mucronate, yellow, 4.5 - 5 mm; **Sty** short; **Fr** subdivergent; **Se** small, ovoid, reticulate-papillose.

S. tsiangii var. **torquatum** (Fröderström) K. T. Fu (Fl. Reipub. Popul. Sin. 34(1): 126, 1984). **T:** China (*Maire* s.n. [P]). – **D:** China (SE Yunnan); rocks on slopes, $\pm$ 2550 m. **I:** Fröderström (1931: 77, as *S. leblanciae* var.).

$\equiv$ *Sedum leblanciae* var. *torquatum* Fröderström (1931).

[1] Differs from var. *tsiangii*: Stems densely mamillate, 5 - 13 cm tall; **L** in whorls of 3 - 4; **Bra** 3, unequal, 2.5 - 6 mm, mamillate; **Pet** broadly ovate; **NSc** subspatulate, tip widened, truncate.

S. tsiangii var. **tsiangii** – **D:** China (W Guizhou, NE Yunnan); moist rocks or cliffs, 400 - 2700 m. **I:** Fröderström (1936a: 163, t. 112); Fu & Fu (1984: t. 28).

[1] Plants 10 - 15 cm tall; **L** alternate, basally sometimes in whorls; **Bra** 5.5 - 6 mm; **Pet** oblong; **NSc** square, flat, somewhat erose.

S. tsinghaicum K. T. Fu (Bull. Bot. Lab. N.-E. Forest. Inst., Harbin 6: 40-41, ill. (p. 43), 1980). **T:** China, Qinghai (*Ma-xin Exped.* 407,565 [Herb. Qinghai Inst. Biol.]). – **D:** China (SE Qinghai); cliffs or slopes and river banks; 3800 - 4100 m. **I:** Fu & Fu (1984: t. 23).

[1] Annual or biennial dark purple herbs, stems branched from the base, 5 - 6 cm tall; **L** alternate, ovate, obtuse, 3 - 6 mm, shortly spurred; **Inf** many-flowered; **Fl** 5-merous, pedicellate; **Sep** narrowly ovate, obtuse, 2.5 - 3 mm; **Pet** basally slightly connate, oblong, apiculate, yellow, $\pm$ 3 mm; **NSc** broadly spatulate, widening at the tip; **Fr** suberect; **Se** narrowly ovoid, reticulate-papillose.

S. tsonanum K. T. Fu (Bull. Bot. Lab. N.-E. Forest. Inst., Harbin 6: 41-42, 1980). **T:** Tibet (*Tibet-Qinghai Exped.* 2831 [PE]). – **D:** S Tibet; rocks on slopes in valleys, 2900 - 3500 m.

[1] Perennial herbs; stems 1 - 3 cm; **L** in whorls of 3, sublinear-spatulate, obtuse, obtusely spurred, green, sometimes speckled with red, 5 - 20 $\times$ 1 - 4 mm; flowering **Br** ascending, rooting at the base, 8 - 10 cm; **Inf** lax many-flowered corymbs; **Bra** L-like; **Fl** 5-merous, subsessile; **Sep** basally free, shortly spurred, slightly unequal, linear-lanceolate, obtuse, speckled with red above the middle, 3.5 - 5 mm; **Pet** basally connate for up to 3 mm, linear-lanceolate, obtuse to acute, yellow, 9 - 11 mm; **NSc** subrectangular, slightly widening towards tip; **Sty** to 2 mm; **Se** narrowly ovoid, reticulate-papillose.

S. tuberculatum Rose (CUSNH 5: 143, 1897). – **D:** Mexico (Oaxaca); 2500 - 3100 m.

[1] Perennial subshrubs with thick creeping **R**; stems stout, erect or nearly erect, spreading, densely papillose; **L** alternate, spatulate-obovate to spatulate-oblanceolate, rounded to obtuse, papillose or sometimes smooth in the upper part of the stem, 6 -

12 mm; flowering **Br** erect; **Inf** small compact few-flowered cymes; **Bra** oblanceolate, ± 5 mm; **Fl** 5-merous; **Sep** basally free, broadly spurred, nearly equal, linear-lanceolate, obtuse, ± 4 mm; **Pet** free to the base, broadly lanceolate, obtuse, broadly mucronate, white, 6 - 7 mm; **NSc** subquadrate, slightly emarginate; **Fr** turgid; **Se** ovoid, reticulate-papillose. – *Cytology*: $2n = 32$.

S. tuberiferum Stojanov & Stefanoff (Notizbl. Bot. Gart. Berlin-Dahlem 11: 1013, 1934). **T**: Bulgaria (*Anonymus* s.n. [SOM]). – **D**: W Bulgaria, Serbia, Macedonia, N Greece; endemic to the mountains, rocky slopes and stony meadows, rocks or cliffs, open places in forests, ± 1500 m. **I**: *Sedum* Soc. Newslett. No. 55: figs. 55, 60, 2000.

[1] Glabrous sparingly branched perennial herbs with erect or ascending non-flowering **Br** arising from small subterranean tubers of ± 0.5 - 1 cm and clothed with brown **Sc**-like **L**, which arise in clusters at the base of old shoots; **L** alternate, crowded at shoot tips, sessile with a 3-lobed spur, linear-oblong to lanceolate-spatulate, to 10 mm, subacute to obtuse, green or greyish-green; flowering **Br** erect, ascending or sometimes pendent, to 15 cm, sometimes with subsidiary **Inf**; **Inf** lax cymes with 2 (-4) monochasial **Br**; **Bra** 2 per **Fl**; **Fl** 5-merous, subsessile; **Sep** broadly sessile, unequal, 2.5 - 3 mm, obtuse; **Pet** free, oblong-lanceolate, to 6 mm, acuminate, yellow; **Fil** yellow; **Anth** yellow; **NSc** subquadrate; **Sty** slender, fairly long; **Fr** stellately patent, brown, with distinct lips along the suture; **Se** ovoid, brown, reticulate-papillose. – *Cytology*: $2n = 32$.

Belonging to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. tuberosum Cosson & Letourneux (Bull. Soc. Bot. France 22: 9, 1875). – **D**: N Tunisia, adjacent Algeria. **I**: Maire (1977: 310).

$\equiv$ *Rhodiola tuberosa* (Cosson & Letourneux) H. Jacobsen (1973) $\equiv$ *Poenosedum tuberosum* (Cosson & Letourneux) Holub (1984).

[1] Glabrous perennial herbs forming small **Ros** at the tip of a simple (rarely branched) subterranean monopodial rhizome to 10×1 cm $\varnothing$; **L** alternate, sessile, oblong-elliptic, flat, $10 - 30 \times 3 - 6$ mm, subacute to rounded, bright green; flowering **Br** axillary, erect or ascending, to 15 cm, loosely leafy, **L** alternating, oblong, flat, $10 - 15 \times 3 - 5$ mm, rounded, with hyaline cells along the margins; **Inf** cymes with (1-) 2 cincinni and 3 - 15 (-20) **Fl**; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile to shortly pedicellate; **Sep** broadly sessile, unequal, oblong-elliptic, obtuse or rounded, 5 mm; **Pet** basally connate for ± 0.3 mm, elliptic-lanceolate, 7 - 10 mm, mucronate; **Fil** yellow; **Anth** yellow; **NSc** square; **Fr** stellately patent, dark brown, with conspicuous lips along the suture; **Se** ovoid, brown, reticulate-papillose. – *Cytology*: $2n = 46$.

Belonging to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. ulricae Fröderström (Bull. Mus. Nation. Hist. Nat., Sér. 2, 1(4): 442-443, 1929). **T**: China, Gansu (*Licent* 4373 [P]). – **D**: E Tibet, China (S Gansu, SE Qinghai); forests, mountain summits, gravelly slopes, 3000 - 4500 m. **I**: Fröderström (1931: 65, t. 38); Fu & Fu (1984: t. 22).

[1] Annual or biennial herbs with erect stems, simple or branched from the base, 3 - 6 cm tall; **L** alternate, broadly linear to suboblong, subacute, 4.5 - 7 mm, shortly spurred; **Fl** 5-merous with 5 **St**; **Sep** basally free, shortly spurred, linear to oblanceolate, subacute, 4 - 4.5 mm; **Pet** lanceolate, subobtusate, white or yellowish, 3.6 - 4 mm; **NSc** narrowly linear, slightly emarginate; **Sty** very short; **Fr** erect or subdivergent, few-seeded; **Se** large, probably reticulate-papillose.

According to Fröderström (1932: 116) merely a small form of *S. perrotii*.

S. uniflorum Hooker & Arnott (Bot. Beechey Voy., 263, 1838). **Nom. illeg.**, Art. 53.1. **T**: Japan, Hokkaido (*Anonymus* s.n. [K]). – **D**: China, Taiwan, Japan, Korea.

[1] Perennial fleshy herbs with tufted creeping and rooting much-branched stems; **L** alternate, narrowly cylindrical-oblong, rounded; **Inf** cymes; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, oblong-linear, obtuse or rounded, slightly cuneate at the base, $\pm 3 \times 1$ mm; **Pet** ovate-spatulate, acute, slightly cuneate at the base, yellow, slightly longer and wider than the **Sep**; **Fr** spreading, with lips along the sutures; **Se** pale brown or yellowish, reticulate-papillose. – *Cytology*: $2n = 18, 20, 30, 38$.

Morphologically as well as cytologically an extremely variable species. Unfortunately, the name is an illegitimate homonym of *S. uniflorum* Rafinesque 1810 ($\equiv$ *Phedimus stellatus*).

S. uniflorum ssp. **boninense** (Yamamoto ex Tuyama) H. Ohba (J. Jap. Bot. 56(6): 181, 1981). **Incorrect name**, Art. 11.4. **T**: Japan (*Soma* s.n. [TI]). – **D**: Japan (Bonin Islands [= Ogasawara Islands]).

$\equiv$ *Sedum boninense* Yamamoto ex Tuyama (1936).

[1] Differs from ssp. *uniflorum*: Subterranean tubers present; **L** linear-elliptic to linear-obovate, 4 - 8 mm; flowering **Br** erect; **Inf** cymes with 3 cincinni.

S. uniflorum ssp. **japonicum** (Siebold ex Miquel) H. Ohba (J. Jap. Bot. 56(6): 181, 1981). **Incorrect name**, Art. 11.4. – **D**: China (Sichuan to Guangdong), Taiwan, Japan (Kyushu, Shikoku, Honshu); on rocks near the coast to subalpine and alpine zones, on stone walls or on roofs. **I**: Fröderström (1931: 89, t. 51, 56, as *S. japonicum*); Fu & Fu (1984: t. 33). **Fig. XLI.c**

≡ *Sedum japonicum* Siebold ex Miquel (1866) ≡ *Sedum uniflorum* var. *japonicum* (Siebold ex Miquel) H. Ohba (1981) (*incorrect name*, Art. 11.4); **incl.** *Sedum japonicum* var. *humile* Miquel (1866); **incl.** *Sedum japonicum* var. *minus* Miquel (1866); **incl.** *Sedum chrysastrum* Hance (1870); **incl.** *Sedum senanense* Makino (1902) ≡ *Sedum japonicum* var. *senanense* (Makino) Makino (1905) ≡ *Sedum uniflorum* var. *senanense* (Makino) H. Ohba (1981) (*incorrect name*, Art. 11.4); **incl.** *Sedum japonicum* f. *rugosum* Fröderström (1924) ≡ *Sedum uniflorum* ssp. *rugosum* (Fröderström) K.-T. Fu (1986) (*incorrect name*, Art. 11.4); **incl.** *Sedum oryzifolium* var. *boreale* Sugimoto (1965) (*nom. inval.*, Art. 32.1c); **incl.** *Sedum japonicum* f. *leucanthemum* Honda (1966).

[1] Differs from ssp. *uniflorum*: Without subterranean tubers; **L** linear, rarely ovate to orbicular, 5 - 18 × 2 - 3 mm; flowering **Br** decumbent at the base, to 15 cm; **Inf** cymes with 3 rarely forked cincinni.

This is the most widely distributed and most variable of the subspecies of *S. uniflorum*. Ohba (1981b: 181-187) and Fu (1986: 110) distinguished 2 varieties: var. *senanense* from Japan can be distinguished by the small narrow leaves (to 12 × 2 mm) and short flowering shoots (to 6 cm); var. *rugosum* from China (Hengduanshan Mts.) differs by the rough stems with flaking bark and very small ovate to orbicular leaves (3 - 5 mm).

S. uniflorum ssp. **oryzifolium** (Makino) H. Ohba (J. Jap. Bot. 56(6): 181, 1981). **Incorrect name**, Art. 11.4. – **D**: Korea, Japan (Kyushu, Shikoku, Pacific side of Honshu, Ryukyu); on rocks near the coast. **I**: Makino (1980: 224).

≡ *Sedum oryzifolium* Makino (1891); **incl.** *Sedum uniflorum* var. *pumilum* H. Ohba (2001) (*incorrect name*, Art. 11.4).

[1] Differs from ssp. *uniflorum*: Without subterranean tubers; **L** clustered in the upper stem parts, linear-elliptic to linear-obovate, 4 - 7 mm; flowering **Br** erect or with short decumbent base; **Inf** cymes with 3 cincinni.

S. uniflorum ssp. **uniflorum** – **D**: Japan (Ryukyu), N Taiwan; sandy places at the coast. **I**: Tang & Huang (1989: t. 14); Tang & Huang (1993: 34).

Incl. *Sedum sasakii* Hayata (1913).

[1] Without subterranean tubers; **L** ± 5 mm; flowering **Br** ascending, short; **Inf** usually 1-flowered.

S. ursi 't Hart (Acta Bot. Neerl. 39(2): 203-206, 1990). **T**: Turkey, Mugla (Eggli 729a [Z, U]). – **D**: Turkey (mountains of W Anatolia).

[1] Glabrous perennial herbs; stems prostrate or ascending, creeping and rooting, branching, forming loose tufts or mats; **L** alternate, densely imbricate, sessile with a short truncate spur, oblong, 8 × 2 mm, terete, rounded, dark green or glaucous; flo-

wering **Br** erect or ascending, simple or with small accessory axillary **Inf**, dead **L** reddish-brown; **Inf** small compact cymes with 2 - 3 cincinni, these rarely forked; **Bra** 2 per **Fl**; **Fl** 5-merous, subsessile; **Sep** broadly sessile, unequal, oblong, to 2.5 mm, rounded; **Pet** basally free or slightly connate, elliptic, 4 - 5 mm, acute or mucronate, yellow; **Fil** yellow; **Anth** yellow; **NSc** square; **Sty** 1 mm; **Fr** stellately patent, brown, with narrow lips along the suture; **Se** ovoid, brown, reticulate-papillose. – **Cytology**: 2n = 12.

Belonging to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. urvillei De Candolle (PSRV 3: 408, 1828). **T**: Ukraine, Crimea (*D'Urville* s.n. [G-DC]). – **Lit**: Jalas & al. (1999: 86). **D**: From Hungary (Danube Basin) throughout the Balkans to Greece and Turkey (C and S Anatolia), also Ukraine (Crimea); on rock ledges and in pockets, rocky slopes and stony meadows, on limestone, 800 - 2450 m. **Fig. XLLe**

Incl. *Sedum acre* var. *hirsutum* Wierzbicki (s.a.); **incl.** *Sedum hillebrandtii* Fenzl (1856) ≡ *Sedum urvillei* ssp. *hillebrandtii* (Fenzl) D. A. Webb (s.a.) ≡ *Sedum sexangulare* ssp. *hillebrandtii* (Fenzl) Nyman (1890) ≡ *Sedum sartorianum* ssp. *hillebrandtii* (Fenzl) D. A. Webb (1963); **incl.** *Sedum sartorianum* Boissier (1856) ≡ *Sedum acre* ssp. *sartorianum* (Boissier) J. A. Huber (1936) ≡ *Sedum urvillei* ssp. *sartorianum* (Boissier) Byalt (1997); **incl.** *Sedum ponticum* Velenovsky (1891) ≡ *Sedum acre* var. *ponticum* (Velenovsky) Stojanov & Stefanoff (s.a.) ≡ *Sedum sartorianum* ssp. *ponticum* (Velenovsky) D. A. Webb (1963); **incl.** *Sedum sibirnyi* Velenovsky (1892) ≡ *Sedum acre* var. *sibirnyi* (Velenovsky) Stojanov & Stefanoff (s.a.) ≡ *Sedum sexangulare* ssp. *sibirnyi* (Velenovsky) Fröderström (1932) ≡ *Sedum sartorianum* ssp. *sibirnyi* (Velenovsky) D. A. Webb (1963); **incl.** *Sedum novakii* Domin (1929).

[1] Perennial herbs, often with ascending or erect much-branched non-flowering shoots, rooting at the base, forming tufts or mats, with the lower stem parts clothed with rather coriaceous dead **L**, lateral **Br** easily detaching; **L** alternate, densely imbricate, conical to linear-oblong, subacute, with a large broad truncate spur, ± 8 mm, dull, dark green or glaucous; dead **L** persistent, basal ½ white, but black or grey towards the tip; flowering **Br** stems 5 - 20 cm, erect or ascending; **Inf** cymes with 2 (-4) cincinni, these rarely forked; **Bra** 2 per **Fl**; **Fl** 5-merous, sessile or subsessile; **Sep** broadly sessile, unequal, lanceolate, subacute; **Pet** lanceolate, acuminate, 5 - 7 mm, yellow; **Fil** yellow; **Anth** yellow; **NSc** square; **Sty** slender; **Fr** stellately patent, brown, with distinct yellowish lips along the suture; **Se** reddish-brown, reticulate-papillose. – **Cytology**: 2n = 32, 48, 64, 80, 96, 112, 128.

Very variable, but representing an almost continuous series of forms. Of all described segregates,

the geographically isolated *S. hillebrandtii* (Danube Basin) seems to be most distinct. However, formal subdivision of the species appears to be futile as there is otherwise no correlation with either the geographical distribution of the different forms or the cytological variation. The species belongs to the comparium of Ser. *Alpestris* A. Berger ('t Hart 1991). – [H. 't Hart]

S. versadense C. H. Thompson (Trans. Acad. Sci. St. Louis 20: 23, t. 12, 1911). **T:** Mexico, Oaxaca (*Trelease* s.n. [MO, US 399714]). – **D:** Mexico (Oaxaca). **I:** Clausen (1959: 222).

Incl. *Sedum chontalense* Alexander (1947).

[1] Perennial herbs or subshrubs with erect or decumbent hairy stems; **L** alternate, obovate or spatulate, truncate or rounded, apiculate to emarginate, basally cuneate, subterete, $\pm$ hairy, green with red at the tip and margins, often flushed reddish or reddish-brown, 7 - 32 $\times$ 4 - 15 mm; flowering **Br** pendulous; **Inf** cymes, drooping in bud; **Bra** prominent, similar to the **L** of flowering **Br**; **Ped** 2 - 3 mm; **Fl** 5- (rarely 4- or 6-) merous; **Sep** broadly sessile, basally connate, very unequal, oblanceolate-elliptic or oblong, acute or abruptly apiculate, green, 5 - 8.1 $\times$ 2.2 - 3.6 mm, erect; **Pet** basally slightly connate, oblanceolate-elliptic or elliptic, apiculate, pinkish-white, $\pm$ 5.5 mm, suberect; **Fil** white; **Anth** red; **NSc** almost square, emarginate, white; **Fr** erect, brown; **Se** ellipsoid, brown, reticulate. – *Cytology*: 2n = 64, 128.

S. versadense var. **versadense** – **D:** Mexico (Oaxaca: Sierra Madre del Sur, S Trans-Mexican Volcanic Belt); $\pm$ 1800 m. **Fig. XLI.d**

[1] **L** broadly cuneate-oblanceolate, 14 - 27 $\times$ 8.5 - 14.6 mm, 4 mm thick, both faces shortly hairy with thin **Ha**, upper face reddish-cream, lower face dark brownish-red. – [U. Eggli]

S. versadense var. **villadioides** Kimmach (CSJA 54(5): 206-208, ill., 1982). **T:** Mexico, Oaxaca (*Bauml & Kimmach* 403 [HNT]). – **D:** Mexico (Oaxaca). **Fig. XLI.a**

[1] Differs from var. *versadense*: **L** linear-oblanceolate, $\pm$ 10 $\times$ 3 mm, 2 mm thick, upper face glabrous, lower face shortly hairy with shorter and thicker **Ha**, both faces faintly reddish-yellow. – [U. Eggli]

S. versicolor (Cosson ex Hamet) Maire (Bull. Soc. Hist. Nat. Afr. Nord 13: 110, 1923). – **D:** Morocco. **I:** Maire (1977: 386).

$\equiv$ *Sedum caeruleum* var. *versicolor* Cosson ex Hamet (1913) $\equiv$ *Oreosedum versicolor* (Cosson ex Hamet) Grulich (1984).

[2] Annual herbs with erect stems to 15 cm tall, simple or branched, glandular-pubescent in the upper parts; **L** alternate, sessile, terete or semiterete, glabrous, linear-oblong to oblong, 6 - 11 $\times$ $\pm$ 2 mm,

obtuse to rounded; **Inf** lax glandular-pubescent cymes with 2 to many cincinni; **Ped** filiform, 3 - 5 mm; **Fl** 5- to 7-merous, ovoid or subglobose in bud; **Sep** broadly sessile, basally slightly connate, ovate to ovate-oblong, $\pm$ 1 mm, obtuse; **Pet** lanceolate to oblong, $\pm$ 3 mm, acuminate, golden-yellow, sometimes with purple stripes or completely purple, keel glandular-pubescent; **Fil** yellow, glabrous; **Anth** yellow; **NSc** cuneate; **Sty** $\pm$ 1 mm; **Fr** suberect or spreading, 2- to 3-seeded; **Se** oblong, brown, costate.

Close to *S. gattefossei* and *S. pubescens*. See *S. gattefossei* for further comments.

S. victorianum Jansson (Acta Horti Gothob. 27: 7-10, ill., 1964). **T:** Myanmar (*Jansson* s.n. [GB]). – **D:** Myanmar (Mt. Victoria).

[?] Annual or biennial herbs with erect or procumbent fleshy stems, 12 - 16 cm tall; **L** alternate, rosulate at the base of young sterile stems, obovate, slightly emarginate, petiolate, carinate, flat, fleshy, 18 - 28 $\times$ 7 - 15 mm; **Inf** dense leafy flattened cymes; **Fl** 5-merous, (sub-) sessile; **Sep** broadly sessile, basally slightly connate, unequal, oblong-linear to oblong-obovate, obtuse to subapiculate, somewhat fleshy, $\pm$ 2 mm; **Pet** slightly connate at the base, lanceolate, acute, slightly narrowing towards the base, yellow, 6 - 9 mm; **Fil** pale yellowish-green; **Anth** pale yellow; **Fr** divergent, basally connate, with lips along the sutures.

S. vietnamense Byalt (Kaktus Klub 2001(1): 28-29, ill., 2001). **T:** Vietnam (*Nguen Tion Hiep & Vander Cloet* NTH2214 [LE]). – **D:** N Vietnam; rocks, 1900 - 2700 m.

[1] Perennial glabrous herbs; stems forming lax tufts, 6 - 15 cm long, few-branched above, ascending to creeping and basally rooting; **L** densely arranged, alternate, ascending, 4 - 8 (-9.5) $\times$ 0.5 - 1.5 mm, lanceolate to linear, somewhat flattened, acute, sessile, basally with a 3-lobed spur; flowering stems few-branched; **Inf** cymose, terminal, 3 - 4.5 cm $\varnothing$, 10- to 15-flowered; **Ped** 0.5 - 3 mm; **Fl** 5-merous, 1.5 - 2 cm $\varnothing$; **Sep** subequal, 4 - 4.5 $\times$ 0.6 - 0.85 mm, slightly shorter than the **Pet**, linear-lanceolate; **Pet** 6.8 - 7.2 mm, free, linear-lanceolate, acute, yellow; **NSc** oblong, 0.5 - 0.65 $\times$ 0.4 - 0.5 mm; **Ca** with 15 - 20 ovules each; **Fr** and **Se** unknown.

Compared with *S. nothodugueyi* and several related taxa in the protologue. – [U. Eggli]

S. villosum Linné (Spec. Pl. [ed. 1], 432, 1753). **T** [lecto]: Switzerland, Schwyz (*Anonymus* s.n. [UPS [Herb. Burser, 16(1): 92]]). – **Lit:** Jalas & al. (1999: 121-122). **D:** W, C and N Europe (in the N to Iceland and Greenland, in the E to Lithuania and Poland), E Canada (islands of the Gulf of St. Lawrence); scattered, wet places and seepages, calcifuge, 1350 - 3000 m. **I:** Lippert (1995: 114). **Fig. XLI.f**

≡ *Sedella villosa* (Linné) Fourreau (1868) (*incorrect name*, Art. 11.4) ≡ *Oreosedum villosum* (Linné) Grulich (1984) ≡ *Hjaltalinia villosa* (Linné) A. Löve & D. Löve (1985); **incl.** *Sedum villosum* var. *pentandrum* De Candolle (1815) ≡ *Sedum pentandrum* (De Candolle) Boreau (1849); **incl.** *Sedum glandulosum* Moris (1827) ≡ *Sedum villosum* var. *glandulosum* (Moris) Battandier (1910) ≡ *Sedum villosum* ssp. *glandulosum* (Moris) P. Fournier (1936) ≡ *Sedum villosum* [?] *glandulosum* (Moris) Sampaio (1947) ≡ *Oreosedum villosum* ssp. *glandulosum* (Moris) Velayos (1989); **incl.** *Sedum insulare* Moris (1827); **incl.** *Sedum glandulosum* var. *minus* Moris (1840); **incl.** *Sedum villosum* var. *alpinum* Hegetschweiler (1840); **incl.** *Sedum villosum* var. *cognense* Müller (1854); **incl.** *Sedum villosum* var. *decandrum* Hamet (1929); **incl.** *Sedum villosum* var. *glabrum* Hamet (1929); **incl.** *Sedum villosum* var. *arcticum* Fröderström (1932); **incl.** *Sedum villosum* var. *decarrhenum* Maire (1977) (*nom. inval.*, Art. 36.1, 37.1); **incl.** *Sedum villosum* var. *pentarrhenum* Maire (1977) (*nom. inval.*, Art. 36.1, 37.1).

[1] Biennial (rarely annual or perennial) herbs, 5 - 15 (-30) cm tall at **Fl** time; **R** fibrous; sterile **Br** short and **L** in **Ros**; **L** alternate, linear, semiterete with flattened upper face, obtuse, 3 - 8 mm, glandular-hairy; flowering **Br** simple or branched from the base; **Fl** few in dense to congested corymbs, 5-merous; **Ped** 3 - 8 mm, glandular-hairy; **Sep** glandular-hairy; **Pet** stellately spreading, 3 - 4.5 mm, pink-red, dorsally with darker midvein area and rarely glandular-hairy; **Ca** erect, first bright yellowish-green, then changing to dark wine-red; **Fr** erect, 4 - 5 mm; **Se** pale brown, longitudinally ridged. – *Cytology*: 2n = 30.

The ecology with a preference for humid places and seepages is remarkable. The taxon is quite variable, esp. as to the size and degree of glandular-hairiness. *S. villosum* is the type of Ser. *Subrosea* 't Hart.

The occurrence *S. villosum* on a few islands in the Gulf of St. Lawrence (off the coast of SE Canada) is documented by Clausen (1975). – [U. Eggli]

S. vinicolor S. Watson (Proc. Amer. Acad. Arts 21: 428, 1885). **T**: Mexico, Chihuahua (*Palmer* 374 p.p. [NY]). – **D**: Mexico (Chihuahua, Durango: Sierra Madre Occidental); 2300 - 2800 m. **Fig. XLI.g**

[1] Glabrous small perennial herbs with fibrous or napiform **R** and erect or horizontal stems, diffusely branching from the base, 3 - 8 cm tall; **L** alternate, lanceolate to ovate, obtuse, broadly spurred, 4 - 6 mm, green or purplish; flowering **Br** erect; **Inf** lax cymes, with 2 - 4 few-flowered spreading cincinni; **Bra** small, ovate, ± 2 mm; **Fl** 5-merous, distinctly pedicellate; **Sep** probably basally free and shortly spurred, ovate, subobtuse, purplish, 2.5 - 3 mm; **Pet** basally slightly connate, oblong, obtuse, broadly submucronate, greenish-white or purplish,

4.5 - 5 mm; **NSc** linear-spatulate, emarginate; **Fr** stellately spreading, very turgid, purple; **Se** ovoid, reticulate.

S. wangii S. H. Fu (Acta Phytotax. Sin. 1(1): 124-125, t. 8: 14-20, 1951). **T**: China, Yunnan (*Wang* 69549 [PE ?]). – **D**: China (NW Yunnan); slopes, ± 3000 m. **I**: Fu & Fu (1984: t. 20).

[1] Small erect annual herbs to 3 cm tall; **L** alternate, linear or oblong-lanceolate, obtuse or subacute, 2 - 5 × 0.7 - 1.5 mm, with a basal spur; **Inf** dense, few- to sometimes 1-flowered; **Ped** slender, to 1 mm; **Fl** 5-merous; **Sep** probably broadly sessile, oblong, acuminate, ± 3 × 1 mm; **Pet** basally connate for 1.5 mm, narrowly obovate, obtuse or subacute, yellow, ± 5.5 × 1.3 mm; **NSc** thin, linear, obtuse, ± 1 mm; **Fr** erect; **Se** oblong-ovoid, small, distinctly papillate.

S. wannanense X. H. Guo & al. (Acta Bot. Yunnan. 21(1): 25, 1999). **T**: China, Anhui (*Guo & al.* 970504 [ANUB, KUN]). – **D**: China (SE Anhui); 300 - 500 m.

Incl. *Sedum wannanense* var. *incarnatum* X. H. Guo & al. (1999).

[1] Small perennial herbs; stems ascending to prostrate, branched, 10 - 15 cm tall; **L** alternate, lower **L** caducous, linear, upper **L** obovate-spatulate, 10 - 20 × 4 - 6 mm, obtuse, basally gradually tapering and decurrent; flowering **Br** to 20 cm, **L** linear; **Inf** terminal cymes, 5 - 10 cm Ø, with 3 main **Br** repeatedly branching; **Bra** spatulate-obovate, 15 - 20 mm, higher up smaller; **Fl** almost sessile, 5-merous; **Sep** ovate, 2 - 5 mm, unequal, basally spurred; **Pet** broadly lanceolate, 5 mm, yellow, acute; **NSc** inversely trapezoid, retuse, ± 0.5 × 0.2 mm; **Ca** lanceolate in outline, gradually tapering into the **Sty**, overall 4 - 5 mm long; **Fr** slightly divergent.

Compared with the similar *S. alfredii* in the protologue. The var. *incarnatum* allegedly differs by the absence of sterile branches, leaves, bracts, as well as having sepals with purple-glandular lower faces, and purple-tipped petals. Both taxa are regarded as possible synonyms of *S. subtile* by Fu & Ohba (2001: 246). – [U. Eggli]

S. weberbaueri (Diels) Thiede & 't Hart (Novon 9: 125, 1999). **T**: Peru, Amazonas (*Weberbauer* 4282 [B]). – **D**: Peru (Amazonas); 2300 m.

≡ *Cotyledon weberbaueri* Diels (1906) ≡ *Altamiranoa weberbaueri* (Diels) A. Berger (1930) ≡ *Villadia weberbaueri* (Diels) Baehni & Macbride (1937).

[1] Glabrous herbs; main stem decumbent, branched, **Br** ascending, 10 - 15 cm; **L** dense but neither rosulate nor imbricate, broadly ovate, semiamplexicaul, 6 - 9 × 2.5 - 5 mm, spurred with a hyaline spur, tip subacute; **Inf** cymose with 2 fastigiate many-flowered cincinni; **Sep** 4 × 1.5 mm; **Pet** to 10 × 2 mm, white, tip elongate, recurved; **St** 6

mm; **NSc** conspicuous; **Ca** 4 mm; **Sty** 1 mm. – [J. Thiede]

S. wenchuanense S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 116, 1965). **T:** China, Sichuan (*Mi-nist. Sylviculturae* 31820 [PE]). – **D:** China (NC Sichuan); exposed poor soils, 1300 - 2400 m.

[1] Perennial herbs with short **R**stock; stems numerous, erect, leafy in the upper part, to 7 cm; **L** alternate, subimbricate, ovate, obtuse to acute, shortly spurred at the rounded base, flat, fleshy, 3 - 4 × 1.5 - 2 mm; **Inf** cymes; **Bra** **L**-like, linear in the upper part of the **Inf**; **Fl** 5-merous, sessile; **Sep** basally free, shortly spurred, ovate to lanceolate, obtuse to acute, 2.5 - 3 × ± 1 mm; **Pet** lanceolate, mucronate, yellowish, 3 - 3.5 mm; **Anth** yellow; **Sty** to 0.8 mm; **Fr** stellately spreading.

S. wilczekianum Font Quer (Cavanillesia 1: 136, 1928). **T:** Morocco (*Font Quer* s.n. [not located]). – **D:** N Morocco; coastal regions, rocky places along the Mediterranean Sea. **I:** Eggli (1988: 106, fig. 61, as *Rosularia*).

≡ *Sedum hirsutum* ssp. *wilczekianum* (Font Quer) Maire (1977) ≡ *Rosularia wilczekiana* (Font Quer) Eggli (1988).

[2] Perennial herbs; **Ros** to 3.5 cm Ø, producing easily detachable short (to 3 cm) leafy stolons with small terminal **Ros**; **L** alternate, semiterete to terete, narrowly ovate to oblong-elliptic, to 14 × 4 mm, obtuse, densely glandular-pubescent and somewhat sticky; flowering **Br** axillary, erect or ascending, usually simple, to 8 cm, with **L** increasingly fewer and smaller towards the tip; **Inf** with 2 (-3) monochasial 3- to 6-flowered **Br** inserted ± 5 mm apart, below with a terminal **Fl**; **Bra** 1 per **Fl**, small; **Ped** erect, 3 - 7 mm; **Fl** 5-merous; **Sep** broadly sessile, ± equal, broadly ovoid, semiterete, 3 - 5 mm, sparsely glandular-pubescent; **Pet** basally connate for ± 2 mm, pink fading to white, with a conspicuous dorsal red stripe, narrowly oblong, 6.5 mm, truncate, with a distinct apical mucro; **Fil** white; **Anth** yellow; **NSc** rectangular-oblong, yellow; **Fr** suberect, brown; **Se** costate. – *Cytology*: 2n = 36.

Molecular systematic studies indicate that this rare Moroccan endemic is closely related to *S. dasyphyllum* and *S. mucizonia*. It is consequently included in Ser. *Dasyphylla*.

S. wilsonii Fröderström (Acta Horti Gothob. 10 (Appendix): 166-167, figs. 1342-1351, 1936). **Nom. inval.**, Art. 36.1. **T:** China (*Wilson* 3571 [NY]). – **D:** China (Hubei).

[1] Annual or biennial herbs with erect or ascending stems, branched from the base, to 20 cm tall; **L** ovate or orbicular, rounded, shortly spurred, mamillate at the tip, long-petiolate, 15 - 30 mm; **Inf** large many-flowered lax corymbs; **Bra** linear-subspatulate, apiculate to acute, 3 - 3.5 mm; **Fl** 5-merous; **Sep** broadly sessile, ovate, subobtuse, ± 1 mm; **Pet**

basally connate for up to 1 mm, ovate, subobtuse, yellowish, 3.5 - 4.5 mm; **NSc** rectangular-subspatulate, slightly emarginate; **Sty** long; **Fr** erect, few-seeded; **Se** subovoid, smooth, probably reticulate-papillose.

This name is unfortunately invalid since no Latin diagnosis was ever published.

S. woronowii Hamet (RSN 8: 315-316, 1910). **T:** China, Yunnan (*Delavay* 2512 [P]). – **D:** China (W Yunnan); ± 2000 m.

[1] Annual or biennial herbs with erect simple stems to 12 cm tall; **L** alternate; **Inf** lax corymbs; **Ped** 0.8 - 1.1 mm; **Fl** 5-merous; **Sep** broadly sessile, slightly connate, unequal, linear-obovate, obtuse, 4 - 9 × 2 - 2.3 mm; **Pet** linear-triangular, acute, 4 - 4.5 × 1.5 mm; **NSc** narrowly linear, obtuse; **Fr** somewhat divergent; **Se** reticulate-papillose.

Insufficiently known.

S. wrightii A. Gray (Pl. Wright. 1: 76, 1852). **T:** USA, Texas (*Wright* 1292 [GH]). – **D:** S USA (New Mexico, Texas), adjacent NE Mexico (Sierra Madre Oriental); partial shade, 330 - 2300 m. **I:** Fröderström (1936a: 54, t. 33-34); Clausen (1975: 203).

Incl. *Sedum listropetalum* Fröderström (s.a.) (*nom. inval.*, Art. 29.1?).

[1] Glabrous perennial tufted herbs with rigid erect or decumbent stems; **Ax** of lower **L** developing **Ros**, which become new plants; **L** alternate, elliptic or oblanceolate-oblong, broadly rounded, with minutely papillose margins, ± 9 × 4 mm, green or yellow-green; flowering **Br** erect, ± 10.5 cm; **Inf** cymes with 1 - 2 monochasial **Br**; **Bra** similar to the **L** but smaller; **Fl** 4- to 7-merous, sessile or subsessile, with pungent musky scent; **Sep** basally free, elliptic or lanceolate-oblong, 4 - 7.5 × 3.5 mm, green, divergent or erect; **Pet** free, oblanceolate-oblong, abruptly acute, with a mucronate appendage, white, 5 - 8 mm; recurved; **Fil** white; **Anth** red or yellow; **NSc** stipitate-reniform, broadly rounded or truncate, yellow; **Fr** erect, basally connate, pale brown; **Se** ellipsoidally or elongatedly pear-shaped, reddish brown, reticulate-papillose. – *Cytology*: 2n = 24, 30-33, 48, 49, 61-77, 72, 96, 120, 144.

S. wrightii ssp. *densiflorum* R. T. Clausen (Variation Spec. Sedum, 13, 1981). **T:** Mexico, Coahuila (*Clausen* 78-1 [CU]). – **D:** Mexico (Coahuila, Nuevo León, Tamaulipas: N Sierra Madre Oriental).

[1] Differs from ssp. *wrightii*: More richly flowering with up to 47 **Fl** per cyme; **Fl** sessile or to 1 mm pedicellate; **Sep** ± 4 mm; **Pet** ± 5 mm; **Se** ± 0.62 mm. – [U. Eggli]

S. wrightii ssp. *priscum* R. T. Clausen (Bull. Torrey Bot. Club 106: 215, 1979). **T:** USA, New Mexico (*Clausen* 75-83 [BH]). – **D:** USA (New Mexico: Sacramento Mts.); 2500 - 2560 m.

[1] Differs from *ssp. wrightii*: Cymes with ± 14 **Fl**; **Fl** 1.1 - 3.7 mm pedicellate; **Sep** ± 4 mm; **Pet** ± 6 mm; **Se** ± 0.52 mm. – [U. Eggli]

S. wrightii *ssp. wrightii* – **D**: S USA (New Mexico, Texas: drainage of the Rio Grande); 350 - 2300 m.

[1] Cymes with ± 10 **Fl**; **Fl** < 1 mm pedicellate; **Sep** 6 mm; **Pet** 8 mm; **Se** ± 0.63 mm. – [U. Eggli]

S. yildizianum Sümbül (Doga Turk Bot. Derg. 14(1): 55-57, ill., 1990). **T**: Turkey, Antalya (*Sümbül* 2231 [HUB, ANK]). – **D**: S Turkey (Cilician Taurus); stony places near melting snow, 1900 - 2000 m, known from the type only.

[1] Annual herbs 2 - 4.5 cm tall, completely glabrous; stems always branched, reddish-brown, without sterile **Br**; **L** sessile, alternate, laxly arranged, oblong-linear, 3 - 8 $\times$ 0.5 - 1 mm, base without spur; **Inf** 4- to 6-branched, erect-ascending, with 11 - 35 (-40) **Fl**; **Fl** 5-merous, pedicellate, stellate; **Sep** yellow with reddish mid-vein, ovate, acute, 1 - 1.25 mm; **Pet** yellow with reddish mid-vein, acute to acuminate, 3 - 3.5 mm; **Fr** glabrous, erect, 3 - 3.5 mm.

Compared with the closely related *S. nanum* in the protologue. 't Hart & Alpınar (2000: 132) treat the taxon as synonym of *S. assyriacum*. – [U. Eggli]

S. yvesii Hamet (RSN 8: 27, 1910). **T**: China, Sichuan (*Farges* s.n. [P]). – **D**: China (E Sichuan); shady moist rocks, 1000 - 1300 m. **I**: Fröderström (1931: 85, t. 50); Fu & Fu (1984: t. 32).

[1] Perennial herbs with slender stems 2 - 8 cm tall; **L** usually in whorls of 4, broadly linear, subobtusate, 5 - 10 mm; flowering **Br** ascending, rooting at the base, 4 - 12 cm; **Inf** few-flowered cymes with 2 - 3 cincinni, these rarely forked; **Fl** 5-merous; **Sep** broadly sessile, unequal, broadly linear to oblanceolate, subobtusate, 3 - 6 mm; **Pet** ovate, subacute, yellowish, ± 5 mm; **NSc** rectangular-spatulate; **Fr** divergent or stellately spreading.

Fu & Ohba (2001: 249) treat *S. obtuso-lineare* as synonym of *S. yvesii* (rather than of *S. lineare* as in this synopsis) and indicate an extension of the range to Taiwan.

S. zentaro-tashiroi Makino (Bot. Mag. (Tokyo) 24: 125, 1910). – **D**: Japan (Honshu, Kyushu), low mountains on the floor of thickets in semi-shade. **I**: Praeger (1921a: 223).

[1] Tufted perennial herbs with creeping or erect to ascending branched stems 5 - 13 cm tall; **L** in whorls of 4 (-5), alternate in the upper stem parts, linear- to obovate-spatulate, obtuse or obtuse-subretuse or acute, narrowing towards the petiolate base; flowering **Br** to 15 cm; **Inf** few-flowered cymes with 2 - 3 cincinni; **Fl** 5-merous, subsessile; **Sep** unequal, linear-lanceolate, obtuse; **Pet** ovate-lanceolate, shortly acuminate, yellow, widely spreading; **Fil** yellow; **Anth** reddish; **NSc** minute,

spatulate-oblong, truncate to rounded. – *Cytology*: $2n = \pm 34$.

Fröderström (1931: 87) included this species in the synonymy of *S. lineare*, but Ohwi (1965: 497) regarded it as a synonym of *S. subtile*. According to Ohba (2001: 28), the species differs from *S. subtile* by the lack of stolons after flowering, narrower and smaller petals, and purplish-red flowering branches with usually ternate leaves.

SEMPERVIVUM

H. 't Hart, B. Bleij & B. Zonneveld

Sempervivum Linné (Spec. Pl. [ed. 1], 464, 1753). **T**: *Sempervivum tectorum* Linné [Lectotype, according to Britton & Rose, North Amer. Fl. 22: 10, 1905.]. – **Lit**: Praeger (1932); Konop (1987); Lippert (1995); Jalas & al. (1999: 52-69). **D**: Europe to NW and C Russia, Balkan Peninsula, Carpathians, Turkey, Iran, Caucasus, Morocco (Atlas Mts.). **Etym**: Lat., an evergreen plant, ever living, houseleek (from Lat. 'semper', always; and Lat. 'vivus', living).

Incl. *Sedum* Adanson (1763) (*nom. illeg.*, Art. 53.1).

T: *Sempervivum tectorum* Linné.

Incl. *Jovibarba* (A. P. De Candolle) Opiz (1852).

T: *Sempervivum hirtum* Linné [Lectotype, designated by Holub & Puzar, Folia Geobot. Phytotax. (Praha) 2: 408, 1967.].

Incl. *Diopogon* Jordan & Fourreau (1868). **T**: *Sempervivum hirtum* Linné.

Incl. $\times$ *Jovivum* G. D. Rowley (1980).

Perennial, rosulate, usually pubescent herbs, generally with both glandular and non-glandular **Ha** often of $\pm$ unequal length, reproducing vegetatively through axillary stolons with rooting terminal **Ros**, rarely through division of **Ros**; **L** alternate, entire, sessile, oblong, flattened, glabrous or pubescent, usually acute or apiculate, generally with marginal ciliae, very fleshy; flowering **Br** terminal, erect; **Inf** usually dense, many-flowered cymes, with (2-) 3 (-4), sometimes forked cincinni; **Bra** small, 1 per **Fl**; **Fl** obdiplostemonous, sessile or subsessile; **Sep** broadly sessile, suberect, basally $\pm$ connate, lanceolate; **Pet** basally free, spreading, generally glabrous ventrally, pink, purple or yellow to almost white; **Fil** rarely glabrous, red, purple, bluish or yellowish to white; **Anth** red or yellow; **Sty** distinct, usually curved; **NSc** $\pm$ square, ± 0.5 mm; **Fr** erect to suberect, rarely glabrous, many-seeded, opening along a ventral suture; **Se** ellipsoid, ovoid or pear-shaped, brown, costate.

Species of the genus *Sempervivum* form a conspicuous element of the alpine and mountainous floras of C and S Europe and Anatolia. The genus most probably evolved from an old polyploid *Sedum* lineage (Favarger & al. 1968) and represents an isolated monophyletic group within the *Sedinae*

('t Hart 1995). *Sempervivum* is rather uniform in habit and gross morphology and phytochemically it also shows extremely little variation, as shown by Stevens (1995) and Stevens & al. (1995). Cytologically, on the other hand, *Sempervivum* seems very variable. The genus comprises a continuous series of basic chromosome numbers ranging from $x = 16$ to $x = 21$ and about half the taxa are polyploid (tetraploids, and 1 hexaploid and 1 octoploid in the $x = 18$ series). The basic numbers are clearly secondary and, most probably, the differences are due to simple dysploid changes. The karyotypes, however, are very similar with small chromosomes of $\pm 1 \mu\text{m}$ or less. In all, the significance of the cytological variation may be limited in the evolutionary sense, as the reproductive isolation (viz. hybrid sterility), is not correlated with differences in chromosome numbers, not even at the diploid level.

In Flora Europaea and other recent systematic accounts of *Sempervivum* the 2 species of Sect. *Jovibarba* are classified in the segregate genus *Jovibarba* Opiz. They differ from *Sempervivum* s.str. by their 6-merous flowers with erect, fringed petals (Parnell & Favarger 1992). Flower morphology of *Sempervivum* is rather uniform, apart from the colour of the petals, and consequently the significance of the different flower structure of the two species of Sect. *Jovibarba* seems overestimated. The 2 sections are sympatric and have a similar habitat preference and ecological amplitude. Furthermore, they have a similar habit and are phytochemically indistinguishable (Stevens & al. 1995). The *jovibarbas* are diploid with a chromosome number of $2n = 38$, which falls within the range of variation in *Sempervivum*. The *jovibarbas* can be hybridized with *Sempervivum* (Favarger & al. 1968) and in a preliminary molecular systematic study they are either in a paraphyletic sistergroup relationship to *Sempervivum* or nested within *Sempervivum* (Kim & al., unpubl. results). Because the similarities between the 2 sections by far outnumber the differences, the *jovibarbas* are classified here at the sectional level ('t Hart & Bleij 1999):

- [1] Sect. *Sempervivum*: **Fl** 8- to 18-merous; **Pet** with entire margins, red, pink, yellow or whitish, spreading during anthesis; **Fil** red, violet, pink, yellow or white. – *Cytology*: $x = 16, 17, 18, 19, 20, 21$. – Throughout the range of the genus.
- [2] Sect. *Jovibarba* De Candolle 1828: **Fl** 6-merous (rarely 7-merous); **Pet** with $\pm$ fimbriate margins, yellow, pale yellow to whitish, erect during anthesis; **Fil** yellowish to white. – *Cytology*: $x = 19$. – Mountains in C and SE Europe, NW and C Russia.

In general, *Sempervivum* species have proved difficult to define and the nomenclature is often complicated and/or confused. Quite often different

authors have subsequently classified certain taxa as species, subspecies, varieties or even as mere forms. In addition, opinions on relationships and the systematic position of many taxa sometimes diverge largely and on some occasions these differences have resulted in seemingly random shifts of certain infraspecific taxa from one species to another. Most of the taxonomic problems in *Sempervivum* are due to the unique biological characteristics of this group. *Sempervivum* is a relatively young, rapidly radiating genus in which evolution seems to be channelled by a peculiar combination of biological constraints: 1) Area fragmentation: *Sempervivum* occurs almost exclusively in open rocky habitats over 1000 to 2000 m; cf. Favarger & Zésiger (1964) and Parnell & Favarger (1992). Consequently the distribution areas of most species are fragmented and local populations (one mountain or mountain range) are in effect reproductively isolated. 2) Clonal growth: The monocarpic *Sempervivum* rosettes flower sparsely – only $\pm 20\%$ of the rosettes each year (Smith 1981), but easily reproduce vegetatively by axillary stolons. 3) Reticulation: Natural hybrids occur frequently, at least in C and S Europe, and hybrid swarms, backcrossings, introgression and/or amphiploidy are commonly met with in populations comprising 2 or more species. By means of a reduction of gene-flow, these constraints promote the occurrence of relatively large, morphologically uniform, local populations which may differ considerably from similarly structured near-by populations.

Although over 200 species have been described, only ± 40 are generally recognized nowadays. The European taxa are relatively well-known and the taxonomy of this group has stabilized over the years. In this account we have mainly followed the second edition of Flora Europaea (Parnell & Favarger 1992). As yet most Asian taxa are still insufficiently known and therefore our treatment is rather conservative.

Hybrids: Most species and cytotypes of *Sempervivum* can be easily hybridized, and do so in nature, at least in C, S and SW Europe. Diploid ($2n = 32 - 42$) and triploid ($2n = 48 - 63$) hybrids are often sterile or semifertile, but at the tetraploid ($2n > 64$) and higher levels, the hybrids are usually fertile and may give rise to extensive hybrid swarms (triparental hybrids have also been mentioned). The excess of nothonyms is rather a hindrance than a help for the proper understanding of the intrapopulational variation due to hybridization, esp. so because of the confusion created by earlier authors in combination with the regrettable practice of botanically naming artificial hybrids. The named hybrids with known parentage are included alphabetically in the account below. The following names refer to hybrids with unknown parentage: *S. ×chanousianum* Pavarino 1928, *S. ×lineatum* A. Berger ex Praeger 1928, *S. ×lineatum* N. E. Brown ex Praeger

1928, and *S. ×michaelis-borsii* Domokos 1935. – The following are hybrids with *S. arachnoideum* as one parent: *S. ×morelianum* Viviani-Morel 1905, *S. ×murithii* Lager 1873, *S. ×spurium* Camus ex Rouy & Camus 1901, and *S. ×valesiacum* Lager ex De La Soie 1875.

In the list of uninterpreted names below, several names might be invalid, or refer to garden hybrids. The names *S. africanum* Miller, *S. bracteatum* Vivian ex Steudel, *S. paniculatum* Solander ex Lowe, *S. uviferum* Webb ex Steudel, and *S. viscosum* Berthelot probably refer to taxa now classified in other genera, but all of them are unresolved because of lack of information.

The following names are of unresolved application but are referred to this genus: *Sempervivum admontense* Graessner (s.a.); *Sempervivum bamberгии* Hampe ex De La Soie (s.a.); *Sempervivum barbatum* De La Soie (s.a.) (*nom. illeg.*, Art. 53.1); *Sempervivum bifurcum* Baxter ex Loudon (s.a.); *Sempervivum cinerascens* Graessner (s.a.) (*nom. illeg.*, Art. 53.1); *Sempervivum claviculatum* Sieber (s.a.); *Sempervivum coperticum* Graessner (s.a.); *Sempervivum dahuricum* hort. ex Correvon (1930); *Sempervivum haffalii* Schott ex Jacques (1864); *Sempervivum hastipetalum* De La Soie (s.a.); *Sempervivum jacquinii* Haworth (1812); *Sempervivum leucopogon* Schnittspahn ex De La Soie (s.a.); *Sempervivum longifolium* Schnittspahn ex Lager (s.a.); *Sempervivum marmoreum* ssp. *rubrifolium* (Schott) Bellia & de Andrade (1971) (*nom. inval.*, Art. 33.2); *Sempervivum moretii* Venzo ex Pampanini (s.a.); *Sempervivum obtusatum* hort. ex Correvon (1930); *Sempervivum penninum* Lager ex De La Soie (s.a.); *Sempervivum purpureum* Graessner (s.a.); *Sempervivum rubricaulis* Correvon (1933); *Sempervivum smidtii* C. Smith ex Nees (1820); *Sempervivum spinulosum* Lager ex De La Soie (s.a.); *Sempervivum stellatum* Pollini (1822) (*nom. illeg.*, Art. 53.1); *Sempervivum transsylvanicum* Baker (s.a.); *Sempervivum trichophorum* Hampe ex De La Soie (s.a.); *Sempervivum ventosicola* Vilmorin ex Correvon (s.a.).

S. ×alidae Zonneveld (Brit. Cact. Succ. J. 4(3): 65, ills., 1986). **T:** (Zonneveld s.n. ex cult. [U]).

= *S. wulfenii* × *S. grandiflorum*, obtained in cultivation.

S. altum Turrill (Izv. Bulg. Bot. Druzh. 7: 126, 1936). **T:** Georgia, Caucasus (*Giuseppi* s.n. [not located]). – **D:** Georgia (Caucasus); 1500 - 2000 m, known only from the type.

[1] **Ros** rather lax, 2.5 - 4 cm Ø; **L** oblanceolate, abruptly mucronate-acuminate, light green, outer **L** with distinct scarlet tip when exposed to sun, ± 19 × 8 mm, ± 3 mm thick; flowering **Br** 12 cm, **L** oblong, ± 20 × 8 mm; **Fl** 12- to 13-merous, to 3 cm Ø; **Sep** spreading; **Pet** carinate, red-purple with

green keel, ± 12 × 3 mm; **Fil** red; **Anth** orange-red; **Sty** red.

Very close to *S. annae* and *S. ossetiense*, but accepted provisionally. Borissova (1939: 16) included *S. altum* in the synonymy of *S. pumilum*, but the latter has smaller rosettes and 11- to 12-merous flowers.

S. annae Gurgendize (Zametki Sist. Geogr. Rast. [Tiflis] 27: 36, 1969). **T:** Georgia, Dushetiya (*Gurgendize & Czuchrukidze* s.n. [TBI]). – **D:** Georgia (E and C Caucasus); subalpine region on rocks in pine-meadows.

[1] **Ros** 3 - 4 (-5) cm Ø; stolons 10 - 20 cm, thick, densely and long pubescent, pale brown; **L** lanceolate, gradually acuminate, long glandular-pubescent, palish green with purple tip, 20 - 25 × 4 - 5 mm; flowering **Br** 15 - 30 (-40) cm, long glandular-pubescent, **L** lanceolate, almost clasping, to 13 × ± 5 mm; **Inf** 15- to 30- (to 40-) flowered; **Ped** unequal; **Fl** 11- to 12- (to 13-) merous, 1.8 - 2 cm Ø; **Sep** lanceolate, acuminate, densely glandular-pubescent dorsally, almost glabrous ventrally, ± 4 × 1 mm; **Pet** scattered glandular-pubescent at the tip, pale rose with purple median stripes and white margins; **Fil** purple, white at the tip; **Anth** orange-purple; **NSc** linear.

Close to *S. caucasicum*.

S. arachnoideum Linné (Spec. Pl. [ed. 1], 465, 1753). **T:** BM [Herb. Clifford]. – **Lit:** Welter (1977). **D:** European mountains (Alps, Appennini, Pyrenees, Cordillera Cantábrica, Corsica); usually calcifuge. **I:** Praeger (1932: 36).

≡ *Sedum arachnoideum* (Linné) E. H. L. Krause (1902); **incl.** *Sempervivum sanguineum* Jeanbernat ex Timbal-Lagrange (1876).

[1] **Ros** densely tufted, compact, subglobose, densely leaved, 0.5 - 2 cm Ø; **L** oblanceolate to oblong-obovate, subacute to apiculate, incurved, 5 - 12 × 3 - 5 mm, usually with brown or red tip, ± covered with a cobwebby veil of long, flexuous, interwoven **Ha** from the tip, upper part and along margins, margins not ciliate; flowering **Br** 4 - 15 cm, **L** red-tipped with apical tuft of arachnoid **Ha**; **Inf** compact, flattish, 5- to 15-flowered; **Fl** 8- to 10-merous, 1 - 1.5 cm Ø; **Sep** connate for up to 3 mm, obtuse, very fleshy, 4 - 5 mm; **Pet** broadly lanceolate or rhombic, apiculate, narrowed at the base, carinate, bright reddish-pink with greenish keel, 7 - 10 × ± 3 mm; **Fil** purple; **Anth** reddish; **Sty** ± 2 mm; **NSc** semicircular, greenish, minute.

An extremely variable species with regard to size and hairiness of the rosettes. The subspecies are rather ill-defined, showing some geographical basis but a considerable overlap (Zonneveld 1981). Generally they are separable on a combination of characters. Hybridization occurs very frequently with other sempervivums whenever occurring together.

S. arachnoideum ssp. **arachnoideum** – **D**: Europe; mainly in the E part of the range of the species. **I**: Lippert (1995: 112, t. 3: fig. 2). **Fig. XLII.b**

Incl. *Sempervivum doellianum* C. B. Lehmann (1850) = *Sempervivum arachnoideum* ssp. *doellianum* (C. B. Lehmann) Nyman (1879) = *Sempervivum arachnoideum* var. *doellianum* (C. B. Lehmann) H. Jaccard (1895); **incl.** *Sempervivum heterotrichum* Schott (1853); **incl.** *Sempervivum arachnoideum* var. *glabrescens* Willkomm (1882); **incl.** *Sempervivum moggridgei* De Smet ex Hooker (1882).

[1] **Ros** to 1.5 cm Ø, cobwebby **Ha** variable in quantity, sometimes rather scanty. – *Cytology*: $2n = 32$ (64).

S. arachnoideum ssp. **tomentosum** (C. B. Lehmann & Schnittspahn) Schinz & Thellung (in Schinz & R. Keller, Fl. Schweiz, ed. 4, 325, 1923). – **D**: Europe; mainly SW part of the range of the species. **I**: Lippert (1995: 81).

= *Sempervivum tomentosum* C. B. Lehmann & Schnittspahn (1856) = *Sempervivum arachnoideum* var. *tomentosum* (C. B. Lehmann & Schnittspahn) Hayek (1924); **incl.** *Sempervivum webbiana* hort. ex C. B. Lehmann & Schnittspahn (1856); **incl.** *Sempervivum laggeri* Schott ex Hallier (1892).

[1] **Ros** 1.5 - 3.5 cm Ø, somewhat flatly depressed, cobwebby **Ha** usually abundant, disappearing in autumn/winter; **L** broader towards tip than in the typical ssp. – *Cytology*: $2n = 64$ (32).

S. armenum Boissier & Huet (in Boissier, Diagn. Pl. Orient. 2(2): 60, 1856). **T**: Turkey (*Huet* s.n. [K [iso]]). – **D**: C and NE Turkey.

[1] **Ros** 2 - 6 cm Ø; stolons few; **L** ovate-lanceolate to spatulate, 1 - 3 cm, glabrous, with a few scattered glandular **Ha** when young, strongly pectinate-ciliate, green with dark purple tip; flowering **Br** 6 - 8 cm, **L** glandular-pubescent; **Fl** 12- to 14-merous, 1.5 - 2 cm Ø; **Sep** acute; **Pet** pale yellow or greenish, purplish towards the base; **Anth** yellow; **Sty** partly pubescent; **NSc** subquadrate, erect; **Fr** follicles completely pubescent. – *Cytology*: $2n = 34, 32$.

A variable species that can be easily distinguished, however, from the other yellow-flowered Anatolian taxa by its pubescent flowers and smaller size.

S. armenum var. **armenum** – **D**: NE Turkey (mainly N Anatolia); limestone gravel and rocky igneous slopes and screes, 1600 - 3200 m.

Incl. *Sempervivum braunii* var. *glabrum* Medwedew (1915).

[1] **Ros** 4 - 6 cm Ø; **Fil** dark purple.

Close to *S. sosnowskyi* according to Muirhead (1972: 246).

S. armenum var. **insigne** Muirhead (Notes Roy. Bot. Gard. Edinburgh 29: 19, 1969). **T**: Turkey,

Ankara (*McNeill* 284 [E]). – **D**: Turkey (C Anatolia); very local, 1200 - 2350 m.

[1] **Ros** 2 - 4 cm Ø; **Fil** violet.

Muirhead (1972: 425) reports an alleged hybrid with *S. armenum* var. *armenum* from E Turkey (Giresun).

S. artvinense Muirhead (Notes Roy. Bot. Gard. Edinburgh 29: 23, fig. 2:2, 1969). **T**: Turkey, Çoruh (*Davis & Hedge* 30410 [E]). – **D**: Turkey, Azerbaijan; igneous rocks, ± 2200 m. **Fig. XLII.c**

[1] **Ros** 3 - 4 cm Ø; stolons 1 - 3, 2 - 4 cm long; **L** oblong-lanceolate, ± 25 × 7 mm, mucronate, somewhat incurved, carinate, green with red tip, tip with some longer stiff **Ha**; **Fl** 12- to 13-merous, ± 2.5 cm Ø; **Sep** ovate, incurved, thick, 3 - 3.5 mm; **Pet** yellowish-white, 11 × 2.5 mm; **Fil** white; **NSc** roundish-square, recurved, yellow.

Closely allied to *S. davisii*, *S. furseorum* and *S. transcaucasicum* according to Muirhead (1972: 247).

S. atlanticum (Ball) Ball (JLSB 16: 454, 1878). **T**: Morocco (*Hooker & al.* s.n. [K?]). – **D**: Morocco (Great Atlas Mts.). **I**: Praeger (1932: 62); Mitchell (1973: 11, pl. 2).

= *Sempervivum tectorum* ssp. *atlanticum* Ball (1873) = *Sempervivum tectorum* var. *atlanticum* (Ball) Hooker (1873).

[1] **Ros** 4 - 6 (-8) cm Ø; stolons short, soon withering, with rather large, somewhat globose offsets; **L** obovate-oblong, oblong-spatulate or oblanceolate, 20 - 30 (-50) × 9 - 10 (-12) mm, obtuse, shortly mucronate, palish green, rarely tipped with red, finely pubescent; flowering **Br** to 30 cm, densely glandular-pubescent, **L** oblong-lanceolate, brilliant vinaceous red-purple during anthesis, 25 - 40 mm; **Inf** cymes usually with forked spreading cincinni; **Fl** 12-merous, 3 - 4 cm Ø; **Sep** connate to 1.5 mm, subglobose, acuminate, green, ± 6 mm; **Pet** narrowly linear, acuminate, white, with broad red-purple median band, ± 15 mm; **Fil** purple; **Anth** dull green; **Sty** subulate, slightly curved; **NSc** suborbicular, minutely glandulose, recurved. – *Cytology*: $2n = 72$.

Geographically isolated; close to *S. tectorum*.

S. atropatanum J. Parnell (Willdenowia 18(2): 419-421, ill., map, 1989). **T**: Iran, Azerbaijan (*Rechinger* 49591 [B, W]). – **D**: N Iran (Azerbaijan); ± 1950 m.

[1] **Ros** 2 - 5.5 cm Ø; stolons short, few, 1 - 3 cm; **L** oblong-elliptic, cuspidate, ± 15 × 7 mm; flowering **Br** 10 - 22 cm, **L** longer and wider than in the **Ros**; **Inf** 4- to 7-flowered cymes, with 2 - 3 cincinni; **Ped** 1 - 3 mm; **Fl** 10- to 11-merous, ± 2 cm Ø; **Sep** connate for up to 2 mm, narrowly triangular, with purple tip, 4 - 5 mm; **Pet** narrowly oblong, acute, pale yellow, 9 - 10 × ± 1.5 mm; **Fil** pale yellow; **Sty** glabrous, ± 1.5 mm; **NSc** rounded, large.

S. xbarbulatum Schott (Österr. Bot. Wochenbl. 3: 91, 1853). **T:** BP 148692.

Incl. *Sempervivum xdelasoiei* C. B. Lehmann & Schnittpahn (1860) = *Sempervivum xbarbulatum* nvar. *delasoiei* (C. B. Lehmann & Schnittpahn) G. D. Rowley (1958); **incl.** *Sempervivum xelegans* Lager (1873); **incl.** *Sempervivum barbatulum* Baker (1874); **incl.** *Sempervivum xhausmannii* Auerswald ex Nymann (1878) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum oligotrichum* Baker (1879); **incl.** *Sempervivum xhybridum* Brügger (1880) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum xdolomiticum* Huter ex Koch (1892) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum xcerdanum* Gautier (1898); **incl.** *Sempervivum xfoucaudii* Gautier (1898); **incl.** *Sempervivum xjeanbernatii* Camus ex Rouy & Camus (1901); **incl.** *Sempervivum xtimbalii* Camus ex Rouy & Camus (1901); **incl.** *Sempervivum xmontaniforme* Huter (1905); **incl.** *Sempervivum xnoricum* Hayek (1909) = *Sempervivum xbarbulatum* nvar. *noricum* (Hayek) G. D. Rowley (1958); **incl.** *Sempervivum xausserdorferi* Huter ex Hegi (1922); **incl.** *Sempervivum xcerbarum* Correvon (1924) (*nom. inval.*, Art. 61.1); **incl.** *Sempervivum xhookeri* hort. ex Praeger (1932).

= *S. arachnoideum* × *S. montanum*. Widespread wherever the parents co-occur.

S. borissovae Wale (Bull. Alpine Gard. Soc. Gr. Brit. 10: 95, 1942). **T:** Caucasus (*Ingwersen* s.n. [K]). – **D:** Caucasus; between rocks on a ridge, ± 1850 m, known from the type only.

= *Sempervivum caucasicum* var. *borissovae* (Wale) Gurgendize (1972).

[1] **Ros** rather open, flat, to 3 cm Ø; stolons short and slender; **L** obovate, strongly mucronate, glabrous, subterete, green, reddish-brown in the upper ½, ± 22 × 9 mm, ± 3 mm thick; flowering **Br** 7 - 10 cm, **L** glabrous except for the dorsal base, green or reddish-brown; **Fl** 12- to 14-merous, ± 2.5 cm Ø; **Sep** reddish, to 8 mm; **Pet** lanceolate, deep rose, with somewhat lighter, slightly irregularly serrated margins; **Fil** lilac to dark red; **Anth** red; **Sty** pale pink. – *Cytology*: 2n = 72.

Closely allied to *S. caucasicum*, but with smaller rosettes and flowering branches. Gurgendize (1972: 29) treated *S. borissovae* as a subspecies of *S. caucasicum*.

S. brevipetalum Kit Tan & Sorger (Pl. Syst. Evol. 154(1-2): 120, 1986). **T:** Turkey, Kars (*Sorger & Kit Tan* 84-62-14 [Herb. Sorger, E]). – **D:** Turkey (NE Anatolia); rocky slopes, ± 1350 m.

[1] **Ros** 2 - 2.5 cm Ø; **L** oblong-lanceolate, apiculate, slightly incurved at the tip, green, reddish-purple towards the tip, 15 - 20 × ± 5 mm; flowering **Br** 17 - 20 cm, **L** lanceolate, smaller and narrower than in the **Ros**; **Inf** 15- to 20-flowered cymes; **Fl** 10-merous, ± 1 cm Ø; **Sep** ovate, acute, 2.5 - 3.3 mm; **Pet** linear, yellow, 6 - 7 × ± 0.8 mm, erect to

suberect; **Fil** yellowish-white; **Anth** yellow; **Sty** ± 1.5 mm.

Closely allied to *S. davisii*.

S. brevipilum Muirhead (Notes Roy. Bot. Gard. Edinburgh 29: 26, t. 2B, fig. 2:3, 1969). **T:** Turkey, Çankiri (*Khan & al.* 724A [E]). – **D:** Turkey (C Anatolia); limestone crevices, very local, 1700 - 2300 m.

[1] **Ros** ± 3 cm Ø; stolons short; **L** ovate, acuminate, recurved and spreading, evenly glandular-pubescent, bluish-green, 10 - 20 × ± 7.5 mm; **Fl** 9- to 11-merous, 1 - 1.5 cm Ø; **Sep** ovate, short, unusually fleshy; **Pet** greenish-yellow, 5 - 7 mm; **Fil** violet; **NSc** rounded, spreading.

Allied to *S. gillianii*.

S. calcareum Jordan (Observ. Pl. Nouv. 7: 26, 1849). – **D:** SW Alps (France, Italy); on limestone rocks. **I:** Praeger (1932: 71, as *S. tectorum* var.); Hegi (1967: 115, fig. 92).

= *Sempervivum tectorum* var. *calcareum* (Jordan) Cariot & St. Lager (1854); **incl.** *Sempervivum columnare* Jordan & Fourreau (1868); **incl.** *Sempervivum racemosum* Jordan & Fourreau (1868); **incl.** *Sempervivum californicum* hort. ex Baker (1874); **incl.** *Sempervivum greenii* Baker (1877).

[1] **Ros** to 6 cm Ø or more; stolons stout, to 4 cm, sparingly leafy when young; **L** usually broad, with a stout pungent mucro, glabrous, rarely glandular-pubescent when young, glaucous or pale green, with a conspicuous purple-brown apical spot on both sides, 20 - 60 × 10 - 15 mm; flowering **Br** 6 - 20 cm, **L** with broad base, almost clasping, pubescent; **Fl** 8- to 10- (to 12-) merous, to 2.5 cm Ø; **Sep** obtuse, with **Ha** of unequal length; **Pet** pale pink to greenish-white, 7 - 8 × ± 2 mm; **Fil** glabrous, bright red-purple; **Anth** orange-yellow; **Sty** subulate, green, rarely suffused with purple; **NSc** semicircular, green. – *Cytology*: 2n = 38.

Resembling some forms of *S. tectorum* and sometimes treated as a subspecies of the latter.

S. cantabricum J. A. Huber (RSN 33: 364, t. 140, 1934). **T:** Spain (*Anonymus* s.n. [not located]). – **Lit:** Smith (1981). **D:** NW Spain.

= *Sempervivum vicentei* ssp. *cantabricum* (J. A. Huber) Fernández Casas & Muñoz Garmendia (1982); **incl.** *Sempervivum vicentei* Wale (1941) (*nom. illeg.*, Art. 53.1).

[1] **Ros** open, 2 - 5 cm Ø; stolons stout, to 6 cm; **L** oblong-obovate, mucronate, dark green with red tip, 20 - 35 × ± 10 mm, sparsely to densely pubescent; flowering **Br** to 16 cm; **Inf** many-flowered (15 - 30 **Fl**); **Fl** 9- to 12-merous, to 1.8 cm Ø; **Sep** obtuse; **Pet** red, pink or white, 9 - 10 × ± 2 mm; **Fil** red; **Anth** red. – *Cytology*: 2n = 72.

The subspecies are geographically separated but show morphological overlap. The type locality of *S. vicentei* Wale is uncertain and can not be assigned

to any of the 3 subspecies. Many authors consider *S. vicentei* Pau as the correct name for *S. cantabricum*. According to Smith (1981) *S. vicentei* Pau, which was described from the Picos de Urbión, has glabrous leaves and is identical in all aspects to *S. tectorum* from the Pyrenees as well as to a similar plant collected from the Picos de Urbión. *S. vicentei* Pau is therefore regarded as synonymous with *S. tectorum*.

The heterotypic subspecies are both unfortunately invalid, since the types were cultivated plants. The subspecies are the result of a very thorough study of the variation of the sempervivums of Spain and in our opinion, the names, though invalid, should be retained for a proper understanding of this group.

S. cantabricum ssp. **cantabricum** – **D:** Spain (Cordillera Cantábrica: Picos de Europa).

[1] **L** densely pubescent, with abundant apical cilia, incurved, red tip > 2 mm; **Fil** pubescent.

S. cantabricum ssp. **guadarramense** M. C. Smith (Lagascalia 10(1): 20, 1981). **Nom. inval.**, Art. 37.1. **T:** Spain, Segovia (*Smith* s.n.). – **D:** Spain (Sierra de Guadarrama, probably also Sierra de Gredos); ± 2100 m.

Incl. *Sempervivum vicentei* ssp. *pau* Fernández Casas (1982) (*nom. inval.*, Art. 37.1).

[1] **L** sparsely pubescent, with few apical cilia, less incurved than in ssp. *cantabricum*, red tip > 2 mm; **Fil** glabrous.

S. cantabricum ssp. **urbionense** M. C. Smith (Lagascalia 10(1): 21, 1981). **Nom. inval.**, Art. 37.1. **T:** Spain, Soria (*Smith* s.n.). – **D:** Spain (Picos de Urbión); ± 2300 m.

[1] **Ros** smaller than in ssp. *cantabricum*; **L** densely pubescent, more incurved, red tip < 2 mm; **Fil** glabrous.

S. caucasicum Ruprecht ex Boissier (Fl. Orient. 2: 796, 1872). **T:** Russia, Dagestan (*Ruprecht* s.n. [LE]). – **D:** Caucasus (Georgia, Azerbaidzhan, Russia [Dagestan]); sandy and calcareous soils, schistose rocks, in alpine and subalpine regions, 1300 - 2600 m. **Fig. XLII.e**

≡ *Sempervivum tectorum* ssp. *caucasicum* (Ruprecht ex Boissier) A. Berger (1930); **incl.** *Sempervivum flagelliferum* Fischer in sched. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sempervivum vermiculare* Gueldenstaedt (1787); **incl.** *Sempervivum tectorum* M. Bieberstein (1808) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum montanum* C. A. Meyer (1831) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum tectorum* Eichwald (1833) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum caucasicum* var. *gracile* Gurgendize (1972).

[1] **Ros** rather open, 3 - 5 cm Ø; stolons short and stout; **L** spatulate, strongly mucronate, glabrous to slightly pubescent, green with a small dark brown

tip, ± 20 × 8 mm wide, ± 3 mm thick; flowering **Br** 12 - 20 cm, shortly glandular-pubescent, **L** lanceolate, acute, flushed with red, 20 - 50 mm; **Inf** few-to many-flowered, corymbiform; **Bra** linear, acute, glandular-pubescent; **Fl** 12- to 14-merous; **Sep** connate for up to ½ of their length, lanceolate, acute; **Pet** linear-lanceolate, acuminate, shortly glandular-pubescent, rose-red with purple stripes, 2 - 2.5× as long as the **Cal**; **Fil** lilac; **Anth** reddish; **NSc** subquadrate-oblong, rounded, straight, flat; **Fr** divergent, green.

The type specimen has leaves that are glandular-pubescent.

S. charadzeae Gurgendize (Zametki Sist. Geogr. Rast. [Tiflis] 27: 32, 1969). **T:** Georgia (*Gurgendize & Czuchrukidze* s.n. [TBI]). – **D:** E Georgia; submontane regions on rocks in forests.

[1] **Ros** (6-) 8 - 12 (-15) cm Ø; stolons 15 - 30 (-35) cm, thick, pubescent, palish red; **L** spatulate, abruptly narrowed towards the tip, densely and shortly glandular-pubescent, pubescence and cilia unequal in length; flowering **Br** 40 - 50 (-60) cm, unequally glandular-pubescent, rarely also with eglandular **Ha**, **L** broadly lanceolate with broad clasping base; **Inf** corymbose, umbellate, with 3 - 5 many-flowered (60 - 80 **Fl**) cincinni; **Bra** lanceolate, long glandular-pubescent, 5 - 7 mm; **Ped** ± 5 mm; **Fl** 13-merous; **Sep** basally connate, lanceolate, gradually acuminate, glabrous ventrally, green, slightly purplish, 5 - 6 mm; **Pet** linear-lanceolate, abruptly acuminate, rose to pale rose, ± 11 × 2.5 mm; **Fil** rose, dark purple towards the base; **Anth** pale yellow; **NSc** subrotund to subquadrate.

Close to *S. caucasicum* but much larger.

S. ×christii F. O. Wolf (Bull. Murith. Soc. Valais. Sci. Nat. 16-18: 29, 1889).

Incl. *Sempervivum ×rupicola* Chenevard & Schmidely (1898).

= *S. grandiflorum* × *S. montanum*. Naturally occurring.

S. ciliosum Craib (BMI 1914: 379, 1914). **T:** K. – **D:** S Balkans.

≡ *Sempervivum leucanthum* var. *ciliosum* (Craib) Hayek (1924) ≡ *Sempervivum borisii* subvar. *ciliosum* (Craib) Hayek (1924).

[1] **Ros** depressed-globose, closed or half open, 2 - 5 cm Ø; stolons slender, to 13 cm; **L** imbricate, oblong-lanceolate to oblong-oblong-lanceolate, both faces convex, 7 - 10 (-25) × 3 - 4 (-6) mm, acute to acuminate, strongly incurved, light green to reddish or reddish-brown, margins with rather stiff spreading cilia to 4 mm, becoming longer towards the tip, interwoven with those of adjoining **L**; flowering **Br** 4 - 10 cm, erect, **L** somewhat wider than in the **Ros**; **Inf** compact cymes with 3 forked cincinni; **Bra** small, narrow; **Fl** 9- to 14-merous, 1.6 - 2.5 cm Ø; **Sep** connate for up to 3.5 mm, acute, reddish-

brown, sometimes purple at the tip, 5 - 7 mm; **Pet** linear-lanceolate, acute to acuminate, yellow, glandular-pubescent all over; **Sty** glabrous, to 4 mm; **NSc** roundish-square, yellowish. – *Cytology*: $2n = 34$.

S. ciliosum ssp. **ciliosum** – **D**: Macedonia, Albania, Bulgaria, Greece.

Incl. *Sempervivum wulfenii* Velenovsky (1891) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum wulfenii* var. *skorpilii* Velenovsky (1902) (*incorrect name*, Art. 11.4); **incl.** *Sempervivum ciliosum* Pancic ex Adamovic (1906) (*nom. inval.*, Art. 32.1c); **incl.** *Sempervivum ciliatum* hort. ex Craib (1914) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum borisii* Degen & Urumov (1915) = *Sempervivum ciliosum* fa. *borisii* (Degen & Urumov) H. Jacobsen (1958) = *Sempervivum ciliosum* var. *borisii* (Degen & Urumov) P. Mitchell (1979); **incl.** *Sempervivum ciliosum* var. *galicicum* A. C. Smith (1978).

[1] Stolons usually long, sometimes very short; **Pet** lemon-yellow, 10 - 12 × ± 1.5 mm; **Fil** yellow.

S. borisii, published 3 days later than *S. ciliosum* and here included as a synonym, allegedly differs only by its longer hairs. *S. wulfenii* var. *skorpilii* is sometimes included as a synonym of *S. leucanthum*.

S. ciliosum ssp. **octopodes** (Turrill) Zonneveld (Succulenta 78(2): 92, 1998). – **D**: SW Macedonia (Baba Planina, Mt. Pelister).

= *Sempervivum octopodes* Turrill (1937); **incl.** *Sempervivum ciliosum* fa. *Mali That* hort. (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Sempervivum jakucsii* Pénzes (1965).

[1] Stolons usually very long; **Pet** pale yellow, tinged with lilac at the base, ± 8 × ± 1.5 mm; **Fil** pale purple.

S. xcomollii Rota (Prosp. Fl. Bergamo, 100, 1853).

Incl. *Sempervivum xhuteri* Kerner (s.a.) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum albidum* C. B. Schnittpahn & Lehmann (1855); **incl.** *Sempervivum xwidderi* C. B. Lehmann & Schnittpahn (1860); **incl.** *Sempervivum xcalcaratum* Baker (1874).

= *S. tectorum* × *S. wulfenii*. Naturally occurring.

S. davisii Muirhead (Notes Roy. Bot. Gard. Edinburgh 29: 22, t. 3B, fig. 2:1, 1969). **T**: Turkey, Çoruh (*Davis & Hedge* 30044 [E]). – **D**: Turkey (NE Anatolia) to NW Iran; igneous rocks on grassy slopes, 700 - 2300 m. **Fig. XLII.a, XLII.d**

[1] **Ros** 3 - 4 cm Ø; stolons few, 2 - 3 cm; **L** ob-lanceolate to obovate, abruptly mucronate, densely and conspicuously pubescent, grey-green, often with reddish-brown tip, 15 - 20 × ± 10 mm; **Inf** compound cymes; **Fl** 13- to 14-merous, ± 2 cm Ø; **Sep** ovate-lanceolate, acute, 2 - 2.5 mm; **Pet** lanceolate, whitish-yellow, 8 - 10 × ± 2 mm; **Fil** white; **Anth** yellow; **NSc** triangular-rounded, spreading.

According to Muirhead (1972: 247) related to *S. artvinense*, *S. furseorum* and *S. transcaucasicum*.

S. dolomiticum Facchinetti (Zeitschr. Ferdinande-ums Tirol ser. 3, 5: 56, 1855). – **D**: Italy (SE Alps, S Tirol); on dolomite and basalt rocks, 1600 - 2500 m.

Incl. *Sempervivum tectorum* var. *angustifolium* Leybold (1854); **incl.** *Sempervivum lehmannii* Schnittpahn (1863); **incl.** *Sempervivum oligotrichum* Dalla Torre (1882) (*nom. illeg.*, Art. 53.1).

[1] **Ros** densely tufted, subglobose, mostly closed, 1 - 5 cm Ø, with whitish centre from flexuous **Ha** on the tips of young **L**; stolons slender, to 2 cm; **L** oblong-lanceolate, acuminate, bright green with brownish tip, 10 - 15 × 3 - 5 mm, sparsely pubescent, apical cilia coarser than lateral ones; flowering **Br** 5 - 15 cm, conspicuously whitish pubescent, **L** somewhat longer than in the **Ros**; **Inf** cymes with 2 - 3 monochasial or forked cincinni, with up to 20 **Fl**; **Fl** 10- to 14-merous, ± 2 cm Ø; **Sep** connate for up to 2 mm, obtuse, deep purple, ± 6 mm; **Pet** broadly lanceolate, shortly acuminate, narrowed at the base, deep reddish-pink, with a central stripe, reddish-brown above, dorsally green at the base, 9 - 10 × ± 2 mm; **Fil** ± glabrous, red; **Anth** red; **Sty** purple or purplish; **NSc** subquadrate, rounded at the tip, pale green. – *Cytology*: $2n = 72$.

The colour of the flowers as well as the presence of hairs on the tips of young leaves indicate a relationship with *S. arachnoideum*.

S. dzhavachischvilii Gurgénidze (Zametki Sist. Geogr. Rast. [Tiflis] 27: 39, 1969). **T**: Russia, Dagestan (*Dzhavachischvili* s.n. [TBI]). – **D**: Russia (E Caucasus: Dagestan).

[1] **Ros** 3 - 5 cm Ø; **L** lanceolate, acuminate, shortly glandular-pubescent, dark green, dorsally very slightly purple, with a dark purple tip, 15 - 38 mm; flowering **Br** 7 - 10 (-12) cm, unequally glandular-pubescent, **L** broadened at the base, slightly narrowed from the middle; **Inf** corymbose-umbellate, 20- to 25-flowered; **Fl** 11-merous, 2 - 2.3 cm Ø; **Ped** glandular-pubescent, unequal, to 10 mm; **Sep** linear-lanceolate, suberect, acuminate, shortly pubescent ventrally, unequally glandular-pubescent dorsally; **Pet** linear-lanceolate, acuminate, glabrous ventrally, incurved, intensely purple, rarely reddish, white marginally, glossy; **Fil** dark purple; **Anth** pale purple, rarely orange; **Sty** glabrous, pale purple; **NSc** square, emarginate; **Fr** green.

Close to *S. pumilum*.

S. ermanicum Gurgénidze (Zametki Sist. Geogr. Rast. [Tiflis] 27: 30, 1969). **T**: Georgia, Dzhava Distr. (*Gurgénidze & al.* s.n. [TBI]). – **D**: Georgia (C Transcaucasia); volcanic rocks, 2600 - 3000 m; known from the type only.

[1] **Ros** 6 - 8 (-10) cm Ø; stolons 20 - 25 cm,

thick, densely glandular-pubescent, brownish; **L** oblong-obovate, abruptly narrowed at the tip, glandular-ciliate marginally, dark green; flowering **Br** 20 - 30 (-40) cm, **L** broadly lanceolate, gradually narrowed towards the tip, 40 - 50 mm; **Inf** corymbose, glandular-pubescent with **Ha** of unequal length; **Fl** 12- to 15-merous, 3 - 3.5 cm Ø; **Ped** unequal in length; **Sep** basally connate, oblong, long glandular-pubescent dorsally and marginally, glabrous ventrally; **Pet** lanceolate, gradually acuminate towards the tip, long glandular-pubescent at the tip, irregularly glandular-pubescent marginally, dark purple-violet, with median dark stripes, white marginally, 15 - 17 mm; **Anth** pale yellowish-purple.

Closely allied to *S. caucasicum* and *S. annae*.

S. ×fauconnetii Reuter (Cat. Pl. Vasc. Genève, 2: 298, 1832).

Incl. *Sempervivum* ×*alatum* Scheele (1843); **incl.** *Sempervivum* ×*piliferum* Jordan (1849); **incl.** *Sempervivum* ×*flavipilum* Hausmann ex Sauter (1857) ≡ *Sempervivum* ×*fauconnetii* nvar. *flavipilum* (Hausmann) G.D. Rowley (1958); **incl.** *Sempervivum* ×*arachnoideo-boutignyanum* Loret (1858); **incl.** *Sempervivum* ×*boutignyano-arachnoideum* Loret (1858); **incl.** *Sempervivum* ×*rubellum* Timbal-Lagrange (1858) ≡ *Sempervivum* ×*fauconnetii* nvar. *rubellum* (Timbal-Lagrange) G. D. Rowley (1958); **incl.** *Sempervivum* ×*schnittspahnii* Lager (1858); **incl.** *Sempervivum* ×*arachnoideo-arvernense* Loret (1862); **incl.** *Sempervivum* ×*arvernensi-arachnoideum* Loret (1862); **incl.** *Sempervivum* ×*hausmannii* C. B. Schnittspahn & Lehmann (1863); **incl.** *Sempervivum* ×*penicillatum* C. B. Lehmann & Schnittspahn (1863); **incl.** *Sempervivum* ×*pilosellum* C. B. Lehmann & Schnittspahn (1863); **incl.** *Sempervivum* ×*arachnoideo-pyrenaicum* Lamotte (1864); **incl.** *Sempervivum* ×*fontanae* Brügger (1864); **incl.** *Sempervivum* ×*lautareticum* Lamotte (1864); **incl.** *Sempervivum* ×*pomelii* Lamotte (1864); **incl.** *Sempervivum* ×*pseudoarachnoideum* Lamotte (1864); **incl.** *Sempervivum* ×*pyrenaico-arachnoideum* Lamotte (1864); **incl.** *Sempervivum* *villosum* Lamotte (1864) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum* ×*chavinii* Lager (1873); **incl.** *Sempervivum* ×*tissieri* Lager ex De La Soie (1873); **incl.** *Sempervivum* ×*funkii* Le Jeune ex Nymann (1878); **incl.** *Sempervivum* ×*angustifolium* A. Kerner (1879); **incl.** *Sempervivum* ×*heerianum* Brügger (1880); **incl.** *Sempervivum* *arachnoideum* var. *piliferum* Cariot & St. Lager (1888); **incl.** *Sempervivum* ×*thomayeri* Correvon (1891); **incl.** *Sempervivum* ×*flahaultii* Gaultier (1898); **incl.** *Sempervivum* ×*oliveri* Gaultier (1898); **incl.** *Sempervivum* ×*thompsonii* Lindsay (1900); **incl.** *Sempervivum* ×*villosulum* Rouy & Camus (1901); **incl.** *Sempervivum* ×*mettenianum* Hausmann ex Hayek (1922) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum* ×*chanousianum* De Marchi (1928).

= *S. arachnoideum* × *S. tectorum*. Frequently occurring wherever the parents grow sympatrically.

S. ×fimbriatum C. B. Schnittspahn & Lehmann (Flora 38: 17, 1855).

Incl. *Sempervivum* ×*roseum* Huter & Gander ex Nymann (1878) (*incorrect name*, Art. H4.1); **incl.** *Sempervivum* ×*fimbriatum* Schott (*pro sp.*) ex Hegi (1921) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum* ×*roseum* nvar. *fimbriatum* G. D. Rowley (1973).

= *S. arachnoideum* × *S. wulfenii*. Naturally occurring.

S. ×funkii F. Braun ex Koch (Flora 25: 4, tab. 1, 1832). **T** [lecto]: Austria, Carinthia (Braun s.n. [BP 14787]).

Incl. *Sempervivum* ×*montanum* Mertens & Koch (1831) (*nom. illeg.*, Art. 53.1).

= *S. arachnoideum* × *S. montanum* × *S. tectorum*. Naturally occurring.

S. furseorum Muirhead (Notes Roy. Bot. Gard. Edinburgh 29: 25, pl. 3A, fig. 1:4, 1969). **T**: Turkey, Trabzon (Furse & Synge 809b [E]). – **D**: NE Turkey (Trabzon); rocky slopes, 1800 - 2500 m; known from the type only. **Fig. XLII.f**

[1] **Ros** 3 - 4 cm Ø; **L** obovate to oblong-spatulate, apiculate, grey-green with purple tips, spreading, 25 - 35 × ± 7 mm, unequally pubescent, margins shortly and densely ciliate; **Fl** 12- to 13-merous, ± 2.5 cm Ø; **Sep** linear-lanceolate, acute; **Pet** recurved, shortly glandular-pubescent ventrally, whitish-green, ± 12 × ± 1 mm; **Fil** white; **Anth** yellow; **NSc** triangular, greenish, small.

According to Muirhead (1972: 248) related to *S. artvinense*, *S. davisii* and *S. transcaucasicum*.

S. gillianii Muirhead (Notes Roy. Bot. Gard. Edinburgh 29: 26, figs. 1:5, 1969). **T**: Turkey, Zonguldak (Davis & Coode 38805A [E]). – **D**: N-C Turkey (N Anatolia); rocky limestone slopes, 1800 - 2100 m, very local.

[1] **Ros** 4 - 6 cm Ø; stolons short; **L** oblong-spatulate, spreading, green, with deep brown, acuminate recurved tips, ± 30 × 10 mm, ± 3 mm thick; **Fl** 13- to 15-merous, ± 2.5 cm Ø; **Sep** ovate-lanceolate, acute, ± 10 × 2 mm; **Pet** greenish-yellow; **Fil** violet; **NSc** rounded, spreading.

Allied to *S. brevipilum*.

S. ×giuseppii Wale (Bull. Alpine Gard. Soc. Gr. Brit. 9(2): 115, 1941).

= *S. arachnoideum* × *S. cantabricum*.

S. glabrifolium Borissova (in Komarov & al. (eds.), Fl. URSS 9: 22, 471, 1939). **T**: Turkey, Çoruh (Turkewicz 768 [LE]). – **D**: NE Turkey (NE Anatolia); igneous conglomerates, 300 - 730 m. **I**: Muirhead (1969: pl. 1B).

[1] **Ros** 1 - 6 cm Ø; stolons numerous; **L** ovate-

lanceolate to spatulate, acute, glabrous, with few scattered glandular **Ha** when young, strongly pectinate-ciliate, olive green, shiny, outer **L** conspicuously flushed with purple in the upper $\frac{1}{2}$, $\pm 10 \times 5$ mm; flowering **Br** to 15 cm, **L** more elongated, glabrous, upper **L** glandular-pubescent; **Inf** many-flowered, corymbiform; **Bra** lanceolate; **Fl** 10- to 14-merous; **Ped** 1 - 2 mm; **Sep** connate for up to 1 mm, ovate, subobtusate, strongly incurved; **Pet** linear to lanceolate-linear, acute, pale yellow or greenish, 6 - 7 mm; **Fil** white to yellow; **Anth** yellow; **Sty** long, erect; **NSc** subquadrate, emarginate, erect; **Se** lanceolate, brown.

Allied to *S. armenum*, but much smaller and with white filaments.

S. globiferum Linné (Spec. Pl. [ed. 1], 464, 1753). **T**: Russia (*Gmelin* s.n. [LINN 632.1]). – **D**: C and SE Europe (S-wards to N Albania and extending to the SW Alps and to NW and C Russia); mountain rocks or on dry, sandy or stony ground in lowlands.

≡ *Diopogon globifer* (Linné) Leute (1966) ≡ *Jovibarba globifera* (Linné) Tjaden ex J. Parnell (1990).

[2] **Ros** $\pm$ globose, usually closed, sometimes open; stolons very slender and short; **L** lanceolate, ovate- or obovate-lanceolate to oblanceolate, acute to acuminate, slightly narrowed at the base, glandular-ciliate marginally, subterete, erect or incurved, sometimes spreading, greenish, often $\pm$ tipped with red or reddish-brown; flowering **Br** glandular-pubescent, **L** triangular-ovate, erect to suberect, $\pm$ clasping, somewhat longer and wider than in the **Ros**; **Inf** flattish dense cymes with 2 - 3 forked, sometimes very shortly branched cincinni; **Fl** 6- (to 7-) merous; **Sep** connate for 2 - 3 mm, lanceolate, acute or acuminate, erect, green, often flushed with red, brown or red-brown; **Pet** lanceolate to suboblong, obtuse to rounded, sometimes acute, strongly carinate, margins and keel $\pm$ fimbriate, esp. towards the tip, erect, greenish-white to greenish-yellow, 15 - 18 mm; **Fil** white to greenish; **Anth** yellow to pale yellow; **NSc** semicircular to subquadrate, $\pm$ retuse, palish green. – *Cytology*: $2n = 38$.

S. globiferum ssp. **allionii** (Jordan & Fourreau) 't Hart & Bleij (Succulenta 78(1): 40, 1999). – **D**: France, Italy (French-Italian Alps, Alpes Maritimes). **I**: Praeger (1932: 96, as *S. allionii*).

≡ *Diopogon allionii* Jordan & Fourreau (1868) ≡ *Sempervivum allionii* (Jordan & Fourreau) Nyman (1879) ≡ *Diopogon hirtus* ssp. *allionii* (Jordan & Fourreau) H. Huber (1961) ≡ *Jovibarba allionii* (Jordan & Fourreau) D. A. Webb (1963) ≡ *Diopogon arenarius* ssp. *allionii* (Jordan & Fourreau) Leute (1966) ≡ *Jovibarba hirta* ssp. *allionii* (Jordan & Fourreau) Soó (1972) ≡ *Jovibarba globifera* ssp. *allionii* (Jordan & Fourreau) J. Parnell (1990); **incl.** *Sempervivum hirtum* Allioni (1789) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum hirsutum* Pollini

(1822); **incl.** *Sempervivum arenarium* Schott (1854) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum austriacum* Nyman (1879).

[2] **Ros** 1.5 - 2.5 (-4) cm Ø; **L** finely glandular-pubescent, very pale yellowish-green, 12 - 15 $\times$ 4 - 5 mm; flowering **Br** 10 - 15 cm; **Sep** minutely glandular-pubescent, very fleshy; **Pet** acute to obtuse, glandular-pubescent on both sides; **Fil** pubescent; **Sty** almost glabrous, ± 3 mm; **NSc** semicircular, 0.75×1 mm or linear-clavate, 2×0.3 mm.

Praeger (1932) included *S. arenarium* in the synonymy of *S. allionii*, but it is also sometimes cited under *Jovibarba globifera* ssp. *hirta*.

S. globiferum ssp. **arenarium** (W. D. J. Koch) 't Hart & Bleij (Succulenta 78(1): 40, 1999). **T**: Austria, Tirol (*Koch* s.n. [not located]). – **D**: Austria, N Italy, Slovenia (S and SE Alps and Karinthian Alps); calcifuge. **I**: Praeger (1932: 103, as *S. arenarium*); Mitchell (1973: 30, pl. 9, as *Jovibarba arenaria*).

≡ *Sempervivum arenarium* W. D. J. Koch (1837) ≡ *Jovibarba arenaria* (W. D. J. Koch) Opiz (1852) ≡ *Diopogon hirtus* ssp. *arenarius* (W. D. J. Koch) H. Huber (1961) ≡ *Diopogon arenarius* (W. D. J. Koch) Leute (1966) ≡ *Jovibarba hirta* ssp. *arenaria* (Koch) Parnell (1988) ≡ *Jovibarba globifera* ssp. *arenaria* (W. D. J. Koch) J. Parnell (1990); **incl.** *Sempervivum hirtum* Sternberg (1806) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum hirtum* var. *pumilum* Bertolini (1842); **incl.** *Sempervivum kochii* Facchinetti (1855); **incl.** *Sempervivum hirtellum* Schott ex Fuss (1857) ≡ *Jovibarba hirta* ssp. *hirtella* (Schott ex Fuss) Soó (1972) ≡ *Jovibarba sobolifera* ssp. *hirtella* (Schott ex Fuss) Soó (1972) ≡ *Jovibarba hirtella* (Schott ex Fuss) Soó (1980); **incl.** *Sempervivum hirtum* var. *glabriusculum* Caruel (1890); **incl.** *Diopogon arenarius* ssp. *pseudohirtus* Leute (1966) ≡ *Jovibarba arenaria* ssp. *pseudohirta* (Leute) Holub (1967) ≡ *Jovibarba globifera* ssp. *pseudohirta* (Leute) Letz (1998).

[2] **Ros** 0.5 - 2 cm Ø; **L** widest at or below the middle, glabrous or slightly pubescent dorsally, 8 - 15 $\times$ 2.5 - 3.5 mm; flowering **Br** 7 - 12 cm, **L** glabrous, strongly ciliate; **Sep** minutely glandular-pubescent, very fleshy; **Fil** shortly pubescent; **NSc** 1 - 1.5 $\times$ ± 2 mm.

Praeger (1932) included *S. hirtellum* in the synonymy of *S. arenarium*, but other authors regard it as a synonym of *Jovibarba globifera* ssp. *globifera*.

S. globiferum ssp. **globiferum** – **D**: Throughout most of the range of the species; calcifuge, usually at low altitudes on dry sandy sites, mainly in pine-forest, also along rocky river banks. **I**: Praeger (1932: 101, as *S. soboliferum*).

Incl. *Jovibarba globifera* ssp. *globifera*; **incl.** *Sempervivum hirtum* Jacquin (1773) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum soboliferum* Sims (1812) ≡ *Jovibarba sobolifera* (Sims) Opiz (1852) ≡

Diopogon soboliferum (Sims) Gandoger (1886) (*nom. inval.*, Art. 24.1?); **incl.** *Sempervivum hirtum* Wimmer & Grabowski (1829) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum globiferum* Reichenbach (1834) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum soboliferum* J. Fleischer & Em. Lindemann (1839) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum ciliatum* Schur (1853) (*nom. illeg.*, Art. 53.1); **incl.** *Diopogon petropolitanum* Gandoger (1886) (*nom. inval.*, Art. 24.1); **incl.** *Sedum soboliferum* Brehm (1896); **incl.** *Sempervivum campaniforme* Schur (1896); **incl.** *Sempervivum petropolitanum* Gandoger (1910) (*nom. inval.*, Art. 32.1c); **incl.** *Diopogon hirtus* ssp. *borealis* H. Huber (1961) $\equiv$ *Jovibarba hirta* ssp. *borealis* (H. Huber) Soó (1977).

[2] **Ros** 1 - 3 cm Ø; **L** widest above the middle, glabrous, very fleshy, $\pm$ 10 mm; flowering **Br** 10 - 20 cm, upper **L** glandular-pubescent; **Sep** glabrous; **Pet** glandular-pubescent on both faces; **Fil** glabrous; **NSc** $\pm$ 1 $\times$ 1 mm.

Praeger (1932: 100, as *S. soboliferum*) described this taxon with glandular-pubescent sepals.

S. globiferum ssp. *hirtum* (Linné) 't Hart & Bleij (Succulenta 78(1): 40, 1999). **T:** Austria (*Anonymus* s.n. [UPS [Herb. Burser XVI(1): 54]]). – **D:** Throughout most of the S part of the range of the species; mainly in mountains, $\pm$ calcicole. **I:** Praeger (1932: 98-99, as *S. hirtum*).

$\equiv$ *Sempervivum hirtum* Linné (1755) $\equiv$ *Jovibarba hirta* (Linné) Opiz (1852) $\equiv$ *Diopogon hirtus* (Linné) Fuchs & H. Huber (1961) $\equiv$ *Jovibarba globifera* ssp. *hirta* (Linné) J. Parnell (1990); **incl.** *Jovibarba hirta* ssp. *hirta*; **incl.** *Sempervivum globiferum* Jacquuin (1762) (*nom. illeg.*, Art. 53.1); **incl.** *Sedum hirtum* Loudon (1846); **incl.** *Sempervivum hillebrandtii* Schott (1852) $\equiv$ *Sempervivum arenarium* var. *hillebrandtii* (Schott) Neumayer (s.a.) $\equiv$ *Sempervivum hirtum* var. *hillebrandtii* (Schott) Hayek (1909) $\equiv$ *Jovibarba hirta* var. *hillebrandtii* (Schott) Soó (1972) $\equiv$ *Sempervivum hirtum* fa. *hillebrandtii* (Schott) Konop & Bendak (1981); **incl.** *Sempervivum neilreichii* Schott & al. (1854) $\equiv$ *Sempervivum hirtum* ssp. *neilreichii* (Schott & al.) Schwarz (s.a.) $\equiv$ *Sempervivum arenarium* ssp. *neilreichii* (Schott & al.) Janchen (1958) $\equiv$ *Jovibarba hirta* ssp. *neilreichii* (Schott & al.) Soó (1972) $\equiv$ *Jovibarba hirta* fa. *neilreichii* (Schott & al.) Konop & Bendak (1981) $\equiv$ *Jovibarba hirta* var. *neilreichii* (Schott & al.) Konop & Bendak (1981); **incl.** *Diopogon austriacus* Jordan & Fourreau (1868); **incl.** *Sempervivum hirtum* fa. *glabrescens* Sabransky (1882) $\equiv$ *Sempervivum hirtum* ssp. *glabrescens* (Sabransky) Jávorka (1924) $\equiv$ *Sempervivum soboliferum* ssp. *glabrescens* (Sabransky) Soó & Jávorka (1951) $\equiv$ *Jovibarba hirta* ssp. *glabrescens* (Sabransky) Holub (1966) $\equiv$ *Jovibarba globifera* ssp. *glabrescens* (Sabransky) Holub (1998); **incl.** *Sempervivum adenophorum* Borbás (1887) $\equiv$ *Sempervivum hirtum* var. *adenophorum* (Borbás) Borbás (s.a.) $\equiv$ *Sempervivum hirtum*

ssp. *adenophorum* (Borbás) Jávorka (1924) $\equiv$ *Jovibarba hirta* ssp. *adenophora* (Borbás) A. Löve & D. Löve (1961); **incl.** *Sempervivum hirtum* var. *raripilum* Beck (1892); **incl.** *Sempervivum hirtum* var. *amblysepalum* Borbás (1899) $\equiv$ *Jovibarba hirta* var. *amblysepala* (Borbás) Soó (1972); **incl.** *Sempervivum simonkaianum* Degen (1902); **incl.** *Sempervivum preissianum* Domin (1932) $\equiv$ *Sempervivum hirtum* ssp. *preissianum* (Domin) Dostal (1948) $\equiv$ *Sempervivum soboliferum* ssp. *preissianum* (Domin) S. Pawlowska (1958) $\equiv$ *Jovibarba hirta* ssp. *preissiana* (Domin) Soó (1972) $\equiv$ *Jovibarba preissiana* (Domin) Omel'chuk-Myakushko & Chopik (1975) $\equiv$ *Jovibarba globifera* ssp. *preissiana* (Domin) Holub (1998); **incl.** *Sempervivum tatrense* Domin (1932) $\equiv$ *Sempervivum hirtum* ssp. *tatrense* (Domin) Dostal (s.a.) $\equiv$ *Sempervivum soboliferum* var. *tatrense* (Domin) S. Pawlowska (1955) $\equiv$ *Jovibarba hirta* ssp. *tatrensis* (Domin) A. Löve & D. Löve (1961) $\equiv$ *Jovibarba hirta* var. *tatrensis* (Domin) Soó (1972).

[2] **Ros** mostly open, 2.5 - 5 (-7) cm Ø; **L** widest at or below the middle, glabrous, spreading, entirely greenish, 15 - 20 (-30) $\times$ 5 - 7 mm, marginal cilia stiff, spreading, white, equal in length; flowering **Br** 10 - 15 (-20) cm, stout, **L** glandular-pubescent, erect; **Sep** usually with normal **Ha**; **Pet** more coarsely glandular-pubescent on the keel, strongly incurved; **Fil** glandular-pubescent; **Sty** 4 - 5 mm; **NSc** $\pm$ 0.7 $\times$ 1 mm, yellow-tipped.

Described by Praeger (1932: 97) with glandular-pubescent sepals and with longer hairs on the keel. The same author included *S. neilreichii* and *S. simonkaianum* in the synonymy of *S. hirtum*, but other authors placed them in *Jovibarba globifera* ssp. *arenaria* and *J. globifera* ssp. *globifera*, respectively.

S. grandiflorum Haworth (Revis. Pl. Succ., 66, 1821). – **D:** NW Italy, SW Switzerland (W-C part of the S Alps (Susa to Simplan); calcifuge. **I:** Praeger (1932: 78). **Fig. XLII.g**

incl. *Sempervivum globiferum* Curtis (1801) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum globiferum* Gaudin (1828) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum gaudinii* Christ (1867) $\equiv$ *Sempervivum wulfenii* ssp. *gaudinii* (Christ) Nyman (1890); **incl.** *Sempervivum braunii* Arcangeli (1882) (*nom. illeg.*, Art. 53.1).

[1] **Ros** pubescent, rather lax, flattish, 2 - 10 (-22) cm Ø; stolons leafy, spreading, 10 - 20 cm; **L** oblong-cuneate, cuspidate, densely pubescent, both faces convex, dark green with reddish-brown tip, with strong resinous or foetid odour, 3 - 6 (-12) $\times$ $\leq$ 1 cm; flowering **Br** 10 - 30 cm, **L** oblong to lanceolate, $\pm$ 3 $\times$ 1 cm; **Inf** cymes with 3 forked cincinni; **Fl** 10- to 15-merous, 2 - 5 cm Ø; **Sep** connate to 2 mm, acute, very fleshy, yellow or greenish-yellow, 5 - 7 mm; **Pet** linear-lanceolate, acuminate, yellowish, with a basal purple spot, 10 - 20 $\times$ 2 - 3 mm; **Fil** purple; **Anth** yellow; **Sty** divergent, glabrous, to 3

mm; **NSc** obovate or fan-shaped, emarginate, yellowish, minute. – *Cytology*: $2n = 80$.

S. ×hayekii G. D. Rowley (Nation. Cact. Succ. J. 13(4): 76, 1958). **Nom. inval.**, Art. 36.1, 37.1.

= *S. grandiflorum* × *S. tectorum*.

S. heuffelii Schott (Österr. Bot. Wochenbl. 2: 18, 1852). **T**: Romania, Siebenbürgen, Banat (*Schott* s.n. [not located]). – **D**: E Europe (E Carpathians, mountains of the Balkan peninsula); calcicole. **I**: Praeger (1932: 94); Mitchell (1973: 29, pl. 29, as *Jovibarba*).

= *Diopogon heuffelii* (Schott) Jordan & Fourreau (1868) = *Jovibarba heuffelii* (Schott) A. Löve & D. Löve (1961); **incl.** *Sempervivum hirtum* Sibthorp & Smith (1806) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum patens* Grisebach & Schenk (1852) = *Sempervivum hirtum* ssp. *patens* (Grisebach & Schenk) Stojanoff & Stefanoff (1924) = *Sempervivum heuffelii* var. *patens* (Grisebach & Schenk) H. Huber (1958) = *Jovibarba heuffelii* ssp. *patens* (Grisebach & Schenk) Holub (1973) = *Jovibarba heuffelii* var. *patens* (Grisebach & Schenk) P. Mitchell (1983); **incl.** *Sempervivum brassai* Schur (1866); **incl.** *Diopogon stramineus* Jordan & Fourreau (1868) = *Sempervivum stramineum* (Jordan & Fourreau) Baker (1874); **incl.** *Sempervivum kopaonikense* Pancic (1874) = *Jovibarba heuffelii* var. *kopaonikensis* (Panic) P. Mitchell (1983); **incl.** *Sempervivum reginae-amaliae* Baker (1877) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum stramineum* Nyman (1879) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum heuffelii* var. *glabrum* Beck & Szyszylowicz (1888) = *Jovibarba heuffelii* var. *glabra* (Beck & Szyszylowicz) hort. (s.a.) (*nom. inval.*, Art. 29.1) = *Sempervivum glabrum* (Beck & Szyszylowicz) A. Berger (1930) = *Sempervivum patens* var. *glabrum* (Beck & Szyszylowicz) Rohlena (1942) = *Jovibarba heuffelii* ssp. *glabra* (Beck & Szyszylowicz) Holub (1967); **incl.** *Sempervivum heuffelii* var. *albanicum* Kitanov (1948); **incl.** *Sempervivum heuffelii* var. *bulgaricum* Cheshmedjiev (1969) = *Diopogon heuffelii* var. *bulgaricus* (Ceschmedjiev) H. Jacobsen (1975); **incl.** *Sempervivum velenovskyi* Cheshmedjiev (1969) = *Jovibarba velenovskyi* (Cheshmedjiev) Holub (1973) = *Diopogon velenovskyi* (Ceschmedjiev) H. Jacobsen (1975).

[2] Pubescent or glabrous, with a thick, shortly branched or lobed **Rstock**; **Ros** flattish, open, 3 - 12 cm Ø, reproducing vegetatively by sessile offsets around the centre; **L** oblong-obovate, spinose-mucronate, with stiff, often deflexed cilia, both faces convex, spreading, light, dark or glaucous green, sometimes with white margins, 20 - 60 × 10 - 15 mm; flowering **Br** 10 - 20 cm, often glabrous, **L** with broad clasping base, lanceolate, acuminate, purple-tipped, 10 - 30 mm; **Inf** dense cymes with 3 forked cincinni; **Fl** 6- (to 7-) merous; **Sep** connate for up to 2.5 mm, linear-lanceolate, acute, green-

ish-yellow, often red-tipped, erect, 6 - 10 mm; **Pet** oblong-obovate, usually tricuspidate, ciliate, scarcely fimbriate, carinate, yellow or yellowish white, erect, 10 - 12 mm; **Fil** pale yellow; **Anth** deep yellow; **Sty** relatively stout, ± 2 mm; **NSc** square to rounded, greenish; **Se** pear-shaped, rather broad. – *Cytology*: $2n = 38$.

Variable in the degree of pubescence as well as in the size and coloration of the leaves. The glabrous form appears to be more common. A glabrous form with connate cilia was described as *S. velenovskyi*.

S. ingwersenii Wale (Bull. Alpine Gard. Soc. Gr. Brit. 10: 90, 1942). **T**: Caucasus (*Ingwersen* s.n. [?]). – **D**: Caucasus; ± 2135 m; known only from the type.

[1] **Ros** to 3 cm Ø; stolons long, brownish-red; **L** obovate to ovate, acute, shortly mucronate, narrowed at base, shortly pubescent, bright green, with small red-brown tip, ± 15 × 7.5 mm; flowering **Br** to 11 cm; **L** pale red apically, ± 11 × 3 mm; **Fl** 13-merous, ± 2 cm Ø; **Sep** connate for up to 3 mm, reddish, ± 6 mm; **Pet** red, with narrow lighter margin; **Fil** pale lilac; **Anth** pinkish-red; **Sty** short, pale orange.

S. iranikum Bornmüller & Gauba (RSN 49: 257, 1940). **T**: Iran (*Gauba* 1513 [B]). – **D**: N Iran.

[1] **Ros** 3 - 7 cm Ø; stolons short; **L** oblong, outer **L** acute, inner **L** shortly cuspidate, minutely glandular-pubescent, margins entire, glaucous green, 25 - 30 × 10 - 15 mm; flowering **Br** 10 - 20 cm, succulent, densely leafy, **L** oblong, shortly acuminate, somewhat longer and wider than in the **Ros** but otherwise similar; **Inf** compact, 3- to 6-flowered corymbs; **Fl** 12- to 14-merous, 2 - 5 cm Ø; **Sep** yellowish-green, ± 6 mm; **Pet** carinate, white with pink stripes on the keel, ± 14 × 2 mm; **Anth** dark purple; **Sty** abruptly recurved.

S. ispartae Muirhead (Notes Roy. Bot. Gard. Edinburgh 29: 21, fig. 3, 1969). **T**: Turkey, Isparta (*Davis* 15923B [E]). – **D**: SW Turkey; metamorphic rocks, ± 1300 m; known from the type only.

[1] **Ros** 3 - 4 cm Ø; **L** ovate to oblong-lanceolate, carinate, glabrous or with few stiff **Ha** on the keel, green to brownish-purple, 15 - 20 × ± 10 mm, margins with dense straight cilia 1 - 2 mm long; flowering **Br** with glandular-pubescent **L** with few stiff **Ha** below; **Fl** 9- to 11-merous, 2 - 3 cm Ø; **Sep** ovate, ± 2 mm; **Pet** greenish-white, ± 10 mm; **Fil** white; **NSc** roundish-square, erect, small.

S. kosaninii Praeger (Bull. Inst. Jard. Bot. Univ. Belgrade 1: 210, 1930). **T**: Macedonia (*Kosanin* s.n. [not preserved]). – **D**: Former S Yugoslavia (Macedonia); limestone, 1800 - 2000 m. **I**: Praeger (1932: 54).

[1] **Ros** large, dense, flat, open, 6 - 8 cm Ø; stolons strong, leafy, to 12 cm, with strong offsets; **L**

oblanceolate, shortly acuminate, $\pm 30 \times 9$ mm, densely glandular-pubescent, dark green, purple at the tips, white at the base, marginal cilia $2\times$ as long as the normal pubescence; flowering **Br** stout, 15 - 20 cm, **L** somewhat longer and narrower than in the **Ros**, shortly glandular-pubescent, red in the upper part; **Fl** 12- to 14-merous, 2 - 3 cm $\varnothing$; **Sep** connate to 5 mm, linear-lanceolate, subacute, 7 - 9 mm; **Pet** linear, acuminate, reddish-purple ventrally, greenish dorsally, with narrow white margins, 10 - 12 mm; **Fil** purple; **Anth** pale red; **Sty** subulate, purplish, 3 - 3.5 mm; **NSc** rounded, contiguous, green. – *Cytology*: $2n = 68$.

Closely related to *S. marmoreum* and most probably derived from one of its subspecies by autopolyploidization or through allopolyploidy after hybridization between *S. marmoreum* and another, still unknown, diploid red-flowered taxon.

S. leucanthum Pancic (Elem. Fl. Bulg., 30, 1883). **T**: Bulgaria (*Anonymus* s.n. [not located]). – **D**: Bulgaria, former Yugoslavia; mountains. **I**: Praeger (1932: 87).

Incl. *Sempervivum kindingeri* Adamovic (1903).

[1] **Ros** subglobose, flattish, 4 - 7 cm $\varnothing$, in loose mats; stolons stout, 5 - 8 cm; **L** oblong-spatulate, apiculate, 20 - 35 $\times$ 8 - 10 mm, finely pubescent, light green with dark red tip, marginal cilia glandular or non-glandular, unequal in length; flowering **Br** 15 - 20 cm, **L** somewhat smaller than in the **Ros**; **Inf** viscid cymes with 3 forked cincinni; **Fl** 11- to 13-merous, ± 2.5 cm $\varnothing$; **Sep** connate for up to 2.5 mm, broadly lanceolate, apiculate, green with purple tip, ± 5 mm; **Pet** oblong-lanceolate to linear-lanceolate, acute or acuminate, whitish to greenish-yellow, 10 - 13 $\times$ ± 1 mm; **Fil** variously coloured, usually pink, almost glabrous; **Anth** yellow; **Sty** ± 3 mm; **NSc** subquadrate, greenish. – *Cytology*: $2n = 64$.

Hybridizes often with *S. ciliosum*. The variable filament colours in some populations may be due to introgression of *S. ciliosum*. The true colour of the filaments is probably purplish. *S. kindingeri* was upheld as a separate species by Parnell & Favarger (1992: 426) but is very doubtful. It could not be found at the type locality and seems very close to *S. leucanthum*, which is reported from nearby. It is therefore best treated as a synonym.

S. marmoreum Grisebach (Spic. Fl. Rumel. 1: 329, 1843). **T**: Greece (*Friedrichsthal* s.n. [GOET, W]). – **D**: Balkans.

$\equiv$ *Sempervivum tectorum* var. *marmoreum* (Grisebach) Boissier (1872) $\equiv$ *Sempervivum tectorum* ssp. *marmoreum* (Grisebach) Maire & Petitmengin (1908); **incl.** *Sempervivum montanum* Sibthorp & Smith (1806) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum tectorum* Boissier (1872) (*nom. illeg.*, Art. 53.1).

[1] **Ros** 3 - 10 cm $\varnothing$; stolons horizontal, finely

pubescent; **L** obovate to obovate-spatulate or broadly lanceolate, mucronate to shortly acuminate, subterete, young **L** (offsets) strongly pubescent; flowering **Br** pubescent, **L** obovate or oblong to lanceolate, $\pm$ apiculate, erect; **Inf** corymbiform, generally with 3 forked cincinni; **Sep** connate for up to 2.5 mm, lanceolate, acute to acuminate, reddish-green, 5 - 6.5 mm; **Pet** linear-lanceolate to oblong-lanceolate, acuminate, red with a whitish stripe along the margins; **Fil** glabrous; **Sty** ± 2 mm; **NSc** subquadrate to semicircular, greenish. – *Cytology*: $2n = 34$.

Comprises all the diploid ($2n = 34$) red-flowered sempervivums of the Balkans. A very variable species, esp. in leaf colour and persistence of pubescence on the leaves. Bellia & Andrade (1972: 39) based *S. marmoreum* ssp. *rubrifolium* on "*S. rubrifolium* Schott", but the latter name is not traced in Index Kewensis or elsewhere. Praeger (1932: 61) distinguished a *S. schlehanii* fa. *rubrifolium* on the base of a garden plant known as *S. rubicundum*, but it is uncertain whether this is the same as "*S. rubrifolium* Schott".

S. marmoreum ssp. *ballsii* (Wale) Zonneveld (Succulenta 78(2): 92, 1999). **T**: Greece (*Balls* s.n. [K]). – **D**: NW Greece.

$\equiv$ *Sempervivum ballsii* Wale (1940).

[1] **Ros** almost globular, ± 3 cm $\varnothing$; stolons usually short; **L** abruptly mucronate, glabrous, with very few cilia in the upper part, inner **L** appressed, outer **L** erect, bright green, tinged with olive-green or yellowish, outer **L** buff to light red, ± 18 ; flowering **Br** to 10 cm; **Inf** small, compact; **Fl** 10- to 12-merous, to 2 cm $\varnothing$; **Pet** pink to almost white, 8 - 10 mm; **Fil** pink; **Anth** orange.

This ssp. comprises the small glabrous forms with pale flowers. It is sometimes regarded as a synonym of *S. marmoreum* ssp. *marmoreum* (Parnell & Favarger 1992).

S. marmoreum ssp. *erythraeum* (Velenovsky) Zonneveld (Succulenta 78(2): 92, 1998). – **D**: Bulgaria; alpine and subalpine rocks, 1000 - 2500 m. **I**: Praeger (1932: 56, as *S. erythraeum*).

$\equiv$ *Sempervivum erythraeum* Velenovsky (1891) $\equiv$ *Sempervivum montanum* var. *erythraeum* (Velenovsky) Stojanov & Stefanoff (1924); **incl.** *Sempervivum montanum* Velenovsky (1898) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum cinerascens* Pancic ex Adamovic (1909); **incl.** *Sempervivum leucanthum* Stojanov & Stefanoff (1924) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum ballii* hort. ex Praeger (1932).

[1] **Ros** open, flattish, 3 - 6 cm $\varnothing$; stolons many, usually short; **L** velvety glandular-pubescent (**Ha** ± 0.05 mm), densely ciliate, usually rose-red, 1 - 4 cm; flowering **Br** 10 - 20 cm, with the **L** shortly pubescent; **Inf** purplish with white pubescence, more branched than in the other ssp., to 7 cm $\varnothing$; **Fl** 11- to 14-merous, to ± 2.5 cm $\varnothing$; **Pet** carinate, strongly

pubescent, keel red-striped, with white indistinct margin, ± 10 mm; **Fil** reddish-purple; **Anth** pale red to purple.

This ssp. comprises the velvety-pubescent forms with hairy pink to red flowers. It hybridizes in nature with *S. ciliosum*.

S. marmoreum ssp. **marmoreum** – **D**: Balkans. **I**: Praeger (1932: 60, as *S. schlehanii*).

Incl. *Sempervivum marmoreum* var. *marmoreum*; **incl.** *Sempervivum assimile* Schott (1853) $\equiv$ *Sempervivum blandum* var. *assimile* (Schott) Stojanov & Stefanoff (1924) $\equiv$ *Sempervivum montanum* var. *assimile* (Schott) Stojanov & Stefanoff (1924); **incl.** *Sempervivum blandum* Schott (1853) $\equiv$ *Sempervivum assimile* ssp. *blandum* (Schott) Simonkai (s.a.) $\equiv$ *Sempervivum schlehanii* ssp. *blandum* (Schott) Ravarut (s.a.) $\equiv$ *Sempervivum schlehanii* var. *blandum* (Schott) Hayek (1924) $\equiv$ *Sempervivum marmoreum* ssp. *blandum* (Schott) Soó (1963) (*nom. inval.*, Art. 33.2); **incl.** *Sempervivum schlehanii* Schott (1853); **incl.** *Sempervivum rubicundum* Schur (1858) $\equiv$ *Sempervivum marmoreum* fa. *rubicundum* (Schur) Soó (1963) (*nom. inval.*, Art. 33.2?); **incl.** *Sempervivum assimile* var. *glabrescens* Borbás (1874); **incl.** *Sempervivum schlehanii* var. *dinaricum* Becker (1923); **incl.** *Sempervivum ornatum* Selwyn Duruz (1930); **incl.** *Sempervivum schlehanii* fa. *brunneifolium* Praeger (1932) $\equiv$ *Sempervivum brunneifolium* (Praeger) Domokos (1936) $\equiv$ *Sempervivum marmoreum* fa. *brunneifolium* (Praeger) Soó (1963); **incl.** *Sempervivum banaticum* Domokos (1936); **incl.** *Sempervivum balcanicum* Stojanov (1951); **incl.** *Sempervivum marmoreum* var. *dinaricum* Soó (1966); **incl.** *Sempervivum marmoreum* fa. *pallidiflorum* Soó (1973).

[1] **Ros** open, flattish, 5 - 10 cm $\varnothing$; stolons usually short; **L** glabrous but pubescent when young, densely ciliate, green, red-tipped or flushed with red or brown, 2 - 5 cm; flowering **Br** 10 - 20 cm, with slightly pubescent **L**; **Inf** to 7 cm $\varnothing$; **Fl** 11- to 13-merous, to ± 2.5 cm $\varnothing$; **Pet** reddish-purple with a white margin giving a paler appearance, ± 10 mm; **Fil** reddish; **Anth** salmon to pale red.

The typical ssp. comprises plants with very acuminate glabrous leaves and petals with a distinctly white margin. *S. brunneifolium* collected by Degen from Trikule near Svinitza in S Hungary was first described as *S. schlehanii* fa. *brunneifolium* by Praeger (1932). It differs from typical *S. schlehanii* by its uniformly brown-coloured leaves, totally glabrous when mature, and turning red in winter. Praeger included *S. ornatum* in the synonymy of *S. schlehanii* fa. *brunneifolium*. Mitchell (1973: 17) treated the latter as *S. marmoreum* fa. *brunneifolium*. According to Praeger (1932: 59) Correvon used the name *S. ornatum* for a different plant. Most likely, however, *S. ornatum* is a hybrid between *S. marmoreum* fa. *rubrifolium* and *S. tectorum* (Zonneveld, pers. comm.). Praeger (1932: 59) further

mentioned *S. schlehanii* var. *dinaricum* Becker. Distinguishing characters are the very acuminate leaves and the smaller, very narrow petals. Mitchell (1973: 17) gives this taxon as *S. marmoreum* var. *dinaricum* Becker.

Reports of *S. marmoreum* from C Italy are based on misidentified specimens of *S. tectorum* var. *arvernense*.

S. marmoreum ssp. **reginae-amaliae** (Heldreich & Sartori ex Boissier) Zonneveld (Succulenta 78(2): 92, 1999). – **D**: SE Albania, Greece, NW Macedonia, S Hungary.

$\equiv$ *Sempervivum reginae-amaliae* Heldreich & Sartori ex Boissier (1872); **incl.** *Sempervivum reginae-amaliae* Heldreich & Guicciardi ex Halácsy (1901) (*nom. illeg.*, Art. 53.1) $\equiv$ *Sempervivum tectorum* var. *reginae-amaliae* (Halácsy) Maire & Petitmengin (1908); **incl.** *Sempervivum macedonicum* Praeger (1930); **incl.** *Sempervivum degenianum* Domokos (1936); **incl.** *Sempervivum marmoreum* var. *angustissimum* S. Priszter (1980); **incl.** *Sempervivum marmoreum* fa. *longirameum* S. Priszter (1985).

[1] **Ros** open, compact, 3 - 10 cm $\varnothing$; stolons stout, usually short; **L** densely glandular-pubescent (**Ha** 0.1 - 0.2 mm), densely ciliate, dull green, rarely rose-red, 1.5 - 5 cm; flowering **Br** 7 - 20 cm, with strongly pubescent **L**; **Inf** to 7 cm $\varnothing$; **Bra** overlapping, large; **Fl** 11- to 14- (sometimes to 20-) merous, to ± 2.5 cm $\varnothing$; **Pet** pink to red-purple, with median red stripe, 8 - 10 mm; **Fil** lilac to red; **Anth** orange to buff or pale red-purple.

This ssp. comprises the strongly pubescent forms with pink to red flowers. It is rather variable in size. The small form with long stolons (4 - 7 cm) and 16- to 18-merous flowers from NW Macedonia is sometimes distinguished as *S. macedonicum* (Parnell & Favarger 1992), but evidently falls within the range of ssp. *reginae-amaliae*. *S. degenianum* Domokos is sometimes regarded as a hybrid of unknown parentage.

S. minus Turrill (HIP 5: t. 3401 + text, 1940). **T**: Turkey, Trabzon (*Balls* s.n. [K]). – **D**: NE Turkey (NE Anatolia); 600 - 2000 m. **I**: Mitchell (1973: 18, pl. 4).

Incl. *Sempervivum minus* var. *glabrum* Wale (1942).

[1] **Ros** 1 - 3 cm $\varnothing$; stolons few, short; **L** oblanceolate to oblong-elliptic, mucronate, green with a bronze cast and purple base, without a strongly marked tip; flowering **Br** with elliptic-lanceolate to ovate **L**; **Inf** 3- to 15-flowered; **Fl** 11- to 12-merous, ± 16 mm $\varnothing$; **Sep** ± 2.5 mm; **Pet** pale yellow, $\pm 8 \times 2.5$ mm; **Fil** pale yellow; **Sty** recurved, 2.5 - 3 mm; **NSc** subquadrate to rounded-oblong, sometimes with a subrotund tip.

S. minus varies in the diameter of the rosettes and the pubescence of the leaves. Var. *glabrum* was de-

scribed with glabrous leaves and larger rosettes to 3 cm Ø. It appears to be completely sympatric with the typical variety (Muirhead 1972: 249).

S. minutum (G. Kunze ex Willkomm) Nyman ex Pau (Bol. Soc. Aragonesa Ci. Nat. 8: 119, 1909). – **D:** S Spain (Sierra Nevada); 1650 - 2150 m.

≡ *Sempervivum tectorum* var. *minutum* G. Kunze ex Willkomm (1874); **incl.** *Sempervivum nevadense* Wale (1941); **incl.** *Sempervivum nevadense* var. *hirtella* Wale (1941); **incl.** *Sempervivum tectorum* ssp. *lainzii* Fernández Casas (1975) ≡ *Sempervivum vicentei* ssp. *lainzii* (Fernández Casas) Fernández Casas (1982); **incl.** *Sempervivum minutum* fa. *glabrescens* Jankalski (1993).

[1] **Ros** ± 3 cm Ø; stolons slender, short; **L** obovate, mucronate, slightly glandular-pubescent, with stout, often deflexed cilia, outer **L** flushed with orange-red, 12 - 18 × 5 - 7 mm; flowering **Br** stout, 3 - 7 (-12) cm, **L** with reddish **Ha** and cilia; **Fl** 9- to 11-merous, ± 2.3 cm Ø; **Pet** reddish-pink, occasionally with a darker red band; **Fil** red, almost glabrous; **Anth** reddish-pink. – *Cytology*: 2n = 108.

The name *S. nevadense* is still frequently used for this taxon, e.g. by Parnell & Favarger (1992: 428).

S. montanum Linné (Spec. Pl. [ed. 1], 465, 1753). **T:** UPS [Herb. Burser]. – **D:** European mountain ranges (Pyrenees, Alps, Appennini, Carpathians, Corsica); calcifuge. **I:** Praeger (1932: 44); Lippert (1995).

Incl. *Sempervivum heterophyllum* Hazslin (s.a.) ≡ *Sempervivum montanum* ssp. *heterophyllum* (Hazslin) Jávorka ex Soó (1930); **incl.** *Sempervivum glaciale* Braun in sched. (s.a.) (nom. inval., Art. 36.1, 37.1) ≡ *Sedum montanum* (Linné) E. H. L. Krause (1902) (nom. illeg., Art. 53.1); **incl.** *Sempervivum flagelliforme* Fischer ex Link (1822); **incl.** *Sempervivum debile* Schott (1852); **incl.** *Sempervivum alpestre* Lamotte (1864); **incl.** *Sempervivum frigidum* Lamotte (1864); **incl.** *Sempervivum minimum* Timbal-Lagrange (1864); **incl.** *Sempervivum monticola* Lamotte (1864); **incl.** *Sempervivum thomasii* Lager ex de la Soie (1875); **incl.** *Sempervivum macranthum* Jeanbernat ex Timbal-Lagrange (1876); **incl.** *Sempervivum pygmaeum* Jeanbernat (1876) (nom. illeg., Art. 53.1); **incl.** *Sempervivum hispidulum* Schott ex Baker (1879); **incl.** *Sempervivum pauciflorum* hort. ex Baker (1879); **incl.** *Sempervivum anomalum* hort. ex Baker (1879) (nom. illeg., Art. 53.1); **incl.** *Sempervivum hungaricum* Gandoger (1886) (nom. inval., Art. 32.1c); **incl.** *Sempervivum candollei* Rouy & Camus (1901); **incl.** *Sempervivum subalpinum* Correvon (1924).

[1] **Ros** clustered, small, rather dense, mostly open; stolons numerous, with persistent **L**; **L** acute, finely and densely glandular-pubescent, viscid, ± 10 (-40) mm; flowering **Br** with elliptic or ovate, acute, glandular-pubescent, suberect **L** ± 10 mm long; **Inf** 2- to 8- (to 13-) flowered; **Bra** lanceolate, glandular-pubescent, small; **Fl** 10- to 15-merous, subsessile, 3 - 5 cm Ø; **Sep** connate to 1 mm, narrowly lanceolate or oblong, acute or obtuse, purplish, ± 5 mm; **Pet** linear-lanceolate, acuminate, with white glandular-pubescent on the ventral side and the margins, vinaceous red, rarely yellowish, ± 2 mm wide; **Fil** pale, almost glabrous; **Sty** reddish, 2 - 3 mm; **NSc** subquadrate, emarginate, whitish; **Ca** green.

The synonymous *S. flagelliforme* was erroneously reported from Siberia (Borissova 1939: 18).

S. montanum ssp. *burnatii* (Wettstein ex Burnat) Hayek (in Hegi, Ill. Fl. Mitt.-Eur. [ed. 1] 4(2): 554, 1922). – **D:** S France (SW Alps).

≡ *Sempervivum burnatii* Wettstein ex Burnat (1906) ≡ *Sempervivum montanum* var. *burnatii* (Wettstein ex Burnat) Praeger (1932); **incl.** *Sempervivum montanum* fa. *maximum* Gamisans (1971).

[1] **Ros** 3 - 5 (-8) cm Ø; stolons long, stout; **L** obovate-cuneate, entirely green, to 7 mm wide, with cilia 2× as long as the **Ha** of the pubescence and to 0.4 (-0.7) mm long; flowering **Br** to 20 (-40) cm; **Fil** glabrous. – *Cytology*: 2n = 42.

Plants described as fa. *maximum* have somewhat larger rosettes (8 - 11 cm Ø), slightly smaller leaves and flowering branches 20 - 27 cm tall.

S. montanum ssp. *carpathicum* (Wettstein ex Prodan) A. Berger (NPF2 18a: 422, 1930). **T** [neo]: (Wettstein s.n. [WU]). – **D:** Carpathians (Slovenia, Romania, Poland, Ukraine).

≡ *Sempervivum carpathicum* Wettstein ex Prodan (1923).

[1] **Ros** 3 - 4 cm Ø; stolons short; **L** obovate, broadest near the tip, cilia almost as long or somewhat longer than the **Ha** of the pubescence, to 0.2 mm long; **Pet** dull purple. – *Cytology*: 2n = 42.

Intermediate between ssp. *burnatii* and ssp. *stiriicum*.

S. montanum ssp. *montanum* – **D:** Throughout most of the range of the species. **Fig.** XLIII.c, XLIII.e

Incl. *Sempervivum montanum* var. *pallidum* Wettstein ex Hegi & Schmid (1966).

[1] **Ros** to 3 cm Ø; stolons to 3 cm, often long, slender, pubescent; **L** broadly to narrowly oblanceolate, entirely green, ± 3 mm wide, cilia to 0.2 mm long, scarcely longer than the **Ha** on the **L** surface; flowering **Br** 5 - 10 (-20) cm; **Fl** 3 - 4 cm Ø; **Pet** purple, 12 - 15 mm, narrow. – *Cytology*: 2n = 42.

The occasionally occurring white-flowered forms were described as var. *pallidum*.

S. montanum ssp. *stiriicum* (Wettstein ex Hayek) Hayek (in Hegi, Ill. Fl. Mitt.-Eur. [ed. 1] 4(2): 554, 1922). – **D:** W Austria (Steiermark). **I:** Praeger (1932: 44, as *S. montanum* var.).

≡ *Sempervivum stiriicum* Wettstein ex Hayek (1909) ≡ *Sempervivum montanum* var. *stiriicum*

(Wettstein *ex* Hayek) Praeger (1932); **incl.** *Sempervivum braunii* Funck *ex* Koch (1835) $\equiv$ *Sempervivum stiriacum* var. *braunii* (Funck *ex* Koch) Wettstein *ex* Hayek (1909) $\equiv$ *Sempervivum montanum* var. *braunii* (Funck *ex* Koch) Wettstein *ex* Hayek (1922) $\equiv$ *Sempervivum montanum* fa. *braunii* (Funck *ex* Koch) Praeger (1932); **incl.** *Sempervivum wulfenii* Bertolini (1842) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum funckii* Maly (1868) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum montanum* Maly (1868) (*nom. illeg.*, Art. 53.1).

[1] **Ros** more open, 2 - 5 cm $\varnothing$; stolons short; **L** oblanceolate, distinctly acuminate, $\pm$ 3 mm broad, tip dark red, cilia shorter than the **Ha** of the pubescence; flowering **Br** to 18 cm; **Fl** to 5 cm $\varnothing$, often deeper purplish, with faint fragrance; **Pet** 16 - 20 mm. – *Cytology*: $2n = 84$.

S. $\times$ morellianum Farer (English Rock Garden 2: 350, s.a.).

= *S. arachnoideum* $\times$ *S. calcareum*.

S. $\times$ nixonii Zonneveld (Sempervivum Fanc. Assoc. Newslett. 7(2): 7, 1981).

Incl. *Sempervivum $\times$ kwedania* P. J. Mitchell (1982); **incl.** *Sempervivum $\times$ mitchellii* Zonneveld (1982); **incl.** *Sempervivum $\times$ smithii* P. J. Mitchell (1987) (*nom. illeg.*, Art. 53.1).

= *S. globiferum* $\times$ *S. heuffelii*.

S. ossetiense Wale (Bull. Alpine Gard. Soc. Gr. Brit. 10: 101, 1942). **T**: Georgia, Ossetia (*Ingwersen* s.n. [not located]). – **D**: Georgia (Caucasus: Ossetia); on limestone, $\pm$ 1520 m; known from the type only; flowers in April.

[1] **Ros** few-leaved, thick, almost globular, to 3 cm $\varnothing$; stolons stout, to 20 cm; **L** oblanceolate to oblong-oblanceolate, pubescent, green, with a small brown tip, $\pm$ 14 $\times$ 6 mm, $\pm$ 4 mm thick; flowering **Br** to 9.5 cm; **Inf** few-flowered; **Fl** 10-merous, $\pm$ 2.5 cm $\varnothing$; **Sep** upturned, with a dark tip; **Pet** with a median band of purple and pink margins; **Fil** purplish-red; **Anth** spotted red, with a small mucro on the tip; **Fr** follicles red.

S. pisidicum Pesmen & Güner (Notes Roy. Bot. Gard. Edinburgh 36(1): 35-37, ill., 1978). **T**: Turkey, Isparta (*Pesmen & Güner* 1902 [HUB, E]). – **D**: SW Turkey; limestone and metamorphic rocks, 1250 - 2400 m.

[1] **Ros** 2 - 9 cm $\varnothing$; stolons 2 - 5 cm; **L** oblong-spatulate, shortly acuminate, pale green, with purple tip, 30 - 50 (-85) $\times$ 10 - 18 mm; flowering **Br** 12 - 45 cm, **L** oblong-lanceolate, long acuminate, shorter than in the **Ros**; **Inf** long branched cymes with up to 135 **Fl**; **Ped** thick, 3 - 15 mm; **Fl** 13- to 15-merous, 1.8 - 2.2 cm $\varnothing$; **Sep** connate for up to 1.5 mm, triangular, acuminate, green, 4 - 5 mm; **Pet** linear-lanceolate, carinate, purple ventrally, green dorsally, 8 - 10 $\times$ 2 - 2.5 mm; **Fil** triangular to sub-

late, dark purple; **Anth** yellow, glabrous; **Sty** $\pm$ 2 mm, glabrous; **NSc** semicircular, small; **Fr** erect to ascending; **Se** ovoid, pale brown.

Closely allied to *S. gillianii*.

S. pittonii Schott & al. (Analect. Bot., 19, 1854). **T** [lecto]: Austria, Styria (*Anonymus* s.n. [BP]). – **D**: E Alps (Austria: Styria near Kraubath); serpentine rocks. **I**: Praeger (1932: 85); Mitchell (1973: 21, pl. 5).

Incl. *Sempervivum braunii* Maly (1868) (*nom. illeg.*, Art. 53.1).

[1] **Ros** subglobose, 2.5 - 5 cm $\varnothing$, forming dense tufts; stolons slender or stout, 2 - 3 cm; **L** crowded, oblong-spatulate to lanceolate-obovate, apiculate, 12 - 25 $\times$ 5 - 7 mm, pubescent, greenish, with a conspicuous dark purple or reddish-brown tip, the marginal cilia unequal in length, often with a red **Gl**; flowering **Br** 5 - 15 (-20) cm, **L** imbricate, lanceolate, acute, purple tipped, erect, $\pm$ 25 $\times$ $\pm$ 7 mm; **Inf** 3- to 15-flowered cymes with 3 cincinni; **Fl** 9- to 12-merous, 2 - 2.5 cm $\varnothing$; **Sep** connate for up to 3.5 mm, acute, green, 3 - 7 mm; **Pet** linear-lanceolate or oblong-lanceolate, acuminate, greenish-yellow, 10 - 14 $\times$ $\pm$ 1 mm; **Fil** pale yellow, almost glabrous; **Anth** yellow; **Sty** $\pm$ 2 mm; **NSc** square to semicircular, spreading, whitish. – *Cytology*: $2n = 64$.

Known from only one locality near Kraubath. Highly endangered due to mining activities.

S. $\times$ praegeri G. D. Rowley (Repert. Pl. Succ. 23: 11, 1974). **Nom. inval.**, Art. 36.1, 37.1.

= *S. leucanthum* $\times$ *S. marmoreum*.

S. pumilum M. von Bieberstein (Fl. Taur.-Caucas. 1: 381, 1808). **T**: Russia, Sev-Osetinskaya (*Anonymus* s.n. [LE]). – **D**: N Caucasus (Russia / Georgia: Ossetia); alpine zone and in xerophytic scrub, 1300 - 3000 m. **I**: Praeger (1932: 58).

Incl. *Sempervivum montanum* Eichwald (1833) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum braunii* Ledebour (1843) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum dominii* Konop & Konopova (1984).

[1] **Ros** open, 1 - 2 cm $\varnothing$, in tufts; stolons many, to 1 cm; **L** lanceolate or oblong-lanceolate, acute or shortly acuminate, sometimes glabrous, both faces convex, greyish-green, spreading, $\pm$ 10 $\times$ 3 - 4 mm, $\pm$ 2 mm thick; flowering **Br** 4 - 10 cm, **L** lanceolate to linear-lanceolate, acuminate, suberect, 10 - 15 mm; **Inf** few-flowered, with 2 - 3 very short cincinni; **Fl** 10- to 12-merous, $\pm$ 2 cm $\varnothing$; **Sep** connate to 2.5 mm, acute or shortly acuminate, reddish, with purple tip, $\pm$ 5 mm; **Pet** lanceolate to oblong-lanceolate, apiculate or shortly acuminate, rose-purple, with pale margin, $\pm$ 10 mm; **Fil** purple, 4 - 6 mm; **Anth** red-purple; **Sty** oblong, obtuse, green or purple; **NSc** square, green; **Fr** with reddish beak. – *Cytology*: $2n = 34$.

S. altum has erroneously been included in the synonymy of this species by Borissova (1939).

S. $\times$ rupicola A. Kerner (Zeitschr. Ferdinandeums Tirol ser. 3, 15: 270, 1870).

Incl. *Sempervivum huteri* Hausmann ex Seboth & Graf (1876); **incl.** *Sempervivum $\times$ theobaldi* Brügger (1880); **incl.** *Sempervivum braunii* Facchinetti (1905) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum $\times$ pernhofferi* Hayek (1909) $\equiv$ *Sempervivum $\times$ rupicola* nvar. *pernhofferi* (Hayek) G.D. Rowley (1958). = *S. montanum* $\times$ *S. wulfenii*. Naturally occurring.

S. ruthenicum W. D. J. Koch ex Schnittspahn & C. B. Lehmann (Flora 38: 5, 1855). **T:** W. – **Lit:** Jalas & al. (1999: 54). **D:** NC Romania, N Moldavia, Ukraine, SW Russia; sands and sandy soils, dry places, mostly in the lowland, sometimes in pine forests. **I:** Praeger (1932: 81, fig. 23, right-hand plant only).

Incl. *Sempervivum globiferum* ssp. *ruthenicum* Koch (1844) $\equiv$ *Sempervivum wulfenii* ssp. *ruthenicum* (C. B. Schnittspahn & Lehmann) Stojanov & Stefanoff (1924); **incl.** *Sempervivum cappadocicum* Boissier (1872); **incl.** *Sempervivum arenarium* Steven ex Baker (1874) (*nom. illeg.*, Art. 53.1).

[1] Very shortly pubescent, **Ha** $\pm$ 0.2 mm; **Ros** closed or open, 4 - 8 cm $\varnothing$; stolons 3 - 5 cm; **L** oblong-obovate to obovate-cuneate, shortly apiculate or acuminate, $\pm$ 50 $\times$ 15 mm, densely pubescent, green, the marginal cilia rather stiff; flowering **Br** 15 - 30 cm, **L** $\pm$ remote and oblong-lanceolate; **Inf** laxly corymbiform; **Bra** linear, acuminate, pubescent; **Ped** 1 - 5 mm; **Fl** 12- to 16-merous; **Sep** basally connate, oblong-ovate or narrowly lanceolate, green, 3 - 4 mm; **Pet** linear to linear-lanceolate, acuminate, greenish-yellow, tinged with purple at the base, $\pm$ 10 $\times$ 1.5 mm; **Fil** white to pink; **Anth** yellow; **NSc** rounded, distinctly upcurved, $\pm$ spreading; **Fr** divergent; **Se** oblong-ovoid, greyish-brown. – **Cytology:** 2n = 64.

Muirhead (1966: 280) regarded *S. braunii* as a synonym of *S. ruthenicum*. According to other authors such as Praeger (1932) it is, however, a synonym of *S. pumilum*. Until recently the name *S. globiferum* Linné has erroneously been used for *S. ruthenicum* from SE Europe (Russia) as well as for other yellow-flowered sempervivums from the Caucasus and Turkey (Muirhead 1966). Accordingly, *S. globiferum* ssp. *aghricum* Kit Tan & Sorger (1986) = *S. transcaasicum* ssp. *aghricum* (Kit Tan & Sorger) Byalt (1998) from E Turkey is not synonymous with *S. ruthenicum*, but most probably belongs to *S. armenum* or another yellow-flowered Turkish *Sempervivum*.

S. sosnowskyi Ter-Chatschaturova (Zametki Sist. Geogr. Rast. [Tiflis] 13: 17, 1947). **T:** Georgia (*Anonymus* s.n. [not located]). – **D:** Georgia.

[1] **Ros** slender, elongate, 10 - 12 (-15) cm $\varnothing$; **L** oblong-spatulate, shortly and gradually acuminate in the upper $\frac{1}{2}$, glabrous, shortly ciliate, reddish at the tip, 60 - 80 $\times$ 15 - 25 mm; flowering **Br** scarcely

and shortly pubescent, 30 - 40 cm, 15 mm $\varnothing$, densely leafy, **L** tongue-shaped, cordate at the base, somewhat longer and wider than in the **Ros**; **Inf** compactly corymbose, with forked cincinni and usually several smaller axillary cincinni; **Bra** lanceolate, shortly glandular-pubescent; **Fl** 14- to 16-merous, 3 - 3.5 cm $\varnothing$, shortly pedicellate; **Sep** oblong-ovate, obtuse, glabrous ventrally, tips reddish; **Pet** linear-lanceolate, yellowish-green, with green stripes in the middle and lilac at the base; **Fil** lilac; **Anth** yellow, glabrous; **NSc** transversely oblong.

S. staintonii Muirhead (Notes Roy. Bot. Gard. Edinburgh 29: 20, t. 2A, fig. 1, 1969). **T:** Turkey, Çoruh (*Stainton & Henderson* 6061 [E]). – **D:** NE Turkey; granite crevices, $\pm$ 1800 m; known from the type only.

[1] **Ros** few-leaved, 3 - 4 cm $\varnothing$; stolons few; **L** ovate or obovate, acute, glabrous at maturity, glaucous, becoming bronze-red in summer, 15 - 20 $\times$ 7 - 8 mm, $\pm$ 5 mm thick, marginal cilia retrorse, $\pm$ 1 mm and glandular; **Fl** 10- to 12-merous, 1 - 1.5 cm $\varnothing$; **Sep** ovate, thick; **Pet** pale yellow, spreading then strongly reflexed, $\pm$ 11 mm; **Fil** white; **Anth** yellow; **NSc** narrowly oblong.

Specimens from the type locality with narrower purplish glandular leaves and smaller flowers are either a closely allied form or a hybrid (Muirhead 1972: 246).

S. $\times$ stenopetalum C. B. Schnittspahn & Lehmann (Flora 38: 18, 1855).

Incl. *Sempervivum $\times$ adenotrichum* Burnat (s.a.); **incl.** *Sempervivum $\times$ densum* C. B. Lehmann & Schnittspahn (1860); **incl.** *Sempervivum $\times$ schottii* C. B. Lehmann & Schnittspahn (1860); **incl.** *Sempervivum $\times$ parviflorum* C. B. Lehmann & Schnittspahn (1864); **incl.** *Sempervivum $\times$ verlotii* Lamotte (1864) $\equiv$ *Sempervivum tectorum* ssp. *verlotii* (Lamotte) Bellia & de Andrade (1972) (*nom. inval.*, Art. 33.2); **incl.** *Sempervivum funckii* Jordan & Fourreau (1866) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum $\times$ modestum* Jordan & Fourreau (1868); **incl.** *Sempervivum $\times$ parvulum* Jordan & Fourreau (1868); **incl.** *Sempervivum $\times$ monticola* Jordan & Fourreau (1868) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum $\times$ rhaeticum* Brügger (1880) $\equiv$ *Sempervivum $\times$ schottii* nvar. *rhaeticum* (Brügger) G. D. Rowley (1958); **incl.** *Sempervivum $\times$ allobrogorum* Beauverd (1931).

= *S. montanum* $\times$ *S. tectorum*. Frequently occurring in the wild.

S. tectorum Linné (Spec. Pl. [ed. 1], 464, 1753). **T:** Europe (*Anonymus* s.n. [LINN]). – **D:** Mountains of W, C and S Europe (from the C Pyrenees to the SE Alps and the S Appennini); frequently cultivated and naturalized from Scandinavia and Ireland across Europe to the Caucasus and Iran. **I:** Praeger (1932: 66, 71); Lippert (1995: 84).

≡ *Sedum tectorum* (Linné) Scopoli (1772); **incl.** *Sempervivum tectorum* var. *glaucescens* Welwitsch (s.a.).

[1] **Ros** usually large, open, (3-) 5 - 7 (-20) cm Ø; stolons stout, to 4 cm, sparingly leafy when young; **L** oblong-lanceolate to obovate, 20 - 60 × 10 - 15 mm, with a stout pungent mucro, glabrous or with a few scattered **Ha** on the surface, both sides convex, dark or somewhat glaucous green, variably tinged with red, cilia conspicuously white; flowering **Br** stout, 20 - 50 cm, **L** ovate-lanceolate, acute, lower **L** glabrous apart from the cilia; **Inf** large, dense, flattish or thyrsoïd, with 40 to > 100 **Fl**; **Bra** linear, acute, hairy; **Fl** 12- to 16-merous, ± 2.5 cm Ø; **Sep** connate for up to 4 mm, acute, ± 8 mm; **Pet** linear-lanceolate, acute, ciliate and pubescent below, dull pink or purple, 9 - 12 × ± 2 mm; **Fil** bright red-purple; **Anth** red; **Sty** subulate, purplish; **NSc** semicircular, green. – *Cytology*: 2n = 72, rarely 36 or 40.

An extremely variable species. It has been split into numerous segregate taxa and a large number of subspecies and varieties have been distinguished by various authors.

S. tectorum var. **arvernense** (Lecoq & Lamotte) Zonneveld (*Succulenta* 78(2): 92, 1999). – **D**: S France (Auvergne), C and S Italy.

≡ *Sempervivum arvernense* Lecoq & Lamotte (1847) ≡ *Sempervivum tectorum* ssp. *arvernense* (Lecoq & Lamotte) Bellia & de Andrade (1972) (*nom. inval.*, Art. 33.2); **incl.** *Sempervivum tectorum* var. *clusianum* Grande (s.a.); **incl.** *Sempervivum montanum* Tenore (1830) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum italicum* I. Ricci (1961) (*nom. inval.*, Art. 37.1, 37.3); **incl.** *Sempervivum riccii* Iberite & Anzalone (2001).

[1] **L** shortly glandular-pubescent.

Turrill identified material collected in S Italy (Monte Tirone) as *S. marmoreum*. These plants have a chromosome number of 2n = 72, however, and thus belong to *S. tectorum*.

S. tectorum var. **tectorum** – **D**: As for the species. **Fig. XLIII.a, XLIII.b**

incl. *Sempervivum vicentei* ssp. *vicentei*; **incl.** *Sempervivum majus* Necker (1768); **incl.** *Sempervivum ciliatum* Gilibert (1782) (*nom. inval.*, Art. 32.8); **incl.** *Sempervivum crassifolium* Salisbury (1796); **incl.** *Sempervivum clusianum* Tenore (1830); **incl.** *Sempervivum glaucum* Tenore (1830) ≡ *Sempervivum tectorum* var. *glaucum* (Tenore) Praeger (1932); **incl.** *Sempervivum alpinum* Grisebach & Schenk (1852) ≡ *Sempervivum tectorum* var. *alpinum* (Grisebach & Schenk) Arcangeli (1894) ≡ *Sempervivum tectorum* ssp. *alpinum* (Grisebach & Schenk) Wettstein (1922); **incl.** *Sempervivum boutignyanum* Billot & Grenier (1853) ≡ *Sempervivum arvernense* fa. *boutignyanum* (Billot & Grenier) Rouy & Camus (1901); **incl.** *Sempervivum*

acuminatum Schott (1853) (*nom. illeg.*, Art. 53.1) ≡ *Sempervivum tectorum* var. *acuminatum* (Schott) Marchesetti (1897); **incl.** *Sempervivum mettenianum* Schnittspahn & C. B. Lehmann (1855); **incl.** *Sempervivum guillemotii* Lamotte (1856); **incl.** *Sempervivum lamottei* Boreau (1859); **incl.** *Sempervivum murale* Boreau (1859); **incl.** *Sempervivum fuscum* C. B. Lehmann & Schnittspahn (1863); **incl.** *Sempervivum spectabile* C. B. Lehmann & Schnittspahn (1863); **incl.** *Sempervivum affine* Lamotte (1864); **incl.** *Sempervivum ambiguum* Lamotte (1864); **incl.** *Sempervivum brachiatum* Lamotte (1864); **incl.** *Sempervivum brevistylum* Lamotte (1864); **incl.** *Sempervivum compactum* Lamotte (1864); **incl.** *Sempervivum lesurinum* Lamotte (1864); **incl.** *Sempervivum maitrei* Lamotte (1864); **incl.** *Sempervivum pyrenaicum* Lamotte (1864); **incl.** *Sempervivum speciosum* Lamotte (1864); **incl.** *Sempervivum vellarum* Lamotte (1864); **incl.** *Sempervivum legrandii* F. W. Schultz (1867); **incl.** *Sempervivum pulverulentum* Dulac (1867); **incl.** *Sempervivum adoxum* Jordan & Fourreau (1868); **incl.** *Sempervivum beugesiacum* Jordan & Fourreau (1868); **incl.** *Sempervivum brevirameum* Jordan & Fourreau (1868); **incl.** *Sempervivum cantalicum* Jordan & Fourreau (1868); **incl.** *Sempervivum celsicaule* Jordan & Fourreau (1868); **incl.** *Sempervivum collinum* Jordan & Fourreau (1868); **incl.** *Sempervivum constrictum* Jordan & Fourreau (1868); **incl.** *Sempervivum corymbosum* Jordan & Fourreau (1868); **incl.** *Sempervivum decoloratum* Jordan & Fourreau (1868); **incl.** *Sempervivum dicranocladon* Jordan & Fourreau (1868); **incl.** *Sempervivum erubescens* Jordan & Fourreau (1868); **incl.** *Sempervivum juratense* Jordan & Fourreau (1868); **incl.** *Sempervivum laetevirens* Jordan & Fourreau (1868); **incl.** *Sempervivum leptopetalum* Jordan & Fourreau (1868); **incl.** *Sempervivum luxurians* Jordan & Fourreau (1868); **incl.** *Sempervivum obovatum* Jordan & Fourreau (1868); **incl.** *Sempervivum pallescens* Jordan & Fourreau (1868) ≡ *Sempervivum tectorum* ssp. *pallescens* (Jordan & Fourreau) Bellia & de Andrade (1971) (*nom. inval.*, Art. 33.2); **incl.** *Sempervivum pallidum* Jordan & Fourreau (1868); **incl.** *Sempervivum praestabile* Jordan & Fourreau (1868); **incl.** *Sempervivum rhodanicum* Jordan & Fourreau (1868); **incl.** *Sempervivum rigidum* Jordan & Fourreau (1868); **incl.** *Sempervivum robustum* Jordan & Fourreau (1868); **incl.** *Sempervivum sabaudum* Jordan & Fourreau (1868); **incl.** *Sempervivum saxosum* Jordan & Fourreau (1868); **incl.** *Sempervivum seusanum* Jordan & Fourreau (1868); **incl.** *Sempervivum trifurcum* Jordan & Fourreau (1868); **incl.** *Sempervivum validum* Jordan & Fourreau (1868); **incl.** *Sempervivum venustum* Jordan & Fourreau (1868); **incl.** *Sempervivum violascens* Jordan & Fourreau (1868); **incl.** *Sempervivum pyrenaicum* Jordan & Fourreau (1868) (*nom. illeg.*, Art. 53.1); **incl.** *Sempervivum requienii* hort. ex Vilmoren (1870); **incl.** *Sempervivum purpurascens* Schott

ex Boissier (1872); **incl.** *Sempervivum schottii* Baker (1874) (*nom. illeg.*, Art. 53.1) $\equiv$ *Sempervivum tectorum* ssp. *schottii* (Baker) Wettstein (1922); **incl.** *Sempervivum cebennense* Lamotte (1877) $\equiv$ *Sempervivum tectorum* ssp. *cebennense* (Lamotte) Bellia & de Andrade (1971); **incl.** *Sempervivum vellatum* Nyman (1878); **incl.** *Sempervivum minutum* Bourgeau *ex* Nyman (1878) (*nom. inval.*, Art. 32.1c); **incl.** *Sempervivum boissieri* hort. *ex* Baker (1879); **incl.** *Sempervivum triste* hort. *ex* Baker (1879); **incl.** *Sempervivum maitrea* Index Kewensis (1895) (*nom. inval.*, Art. 32.1c); **incl.** *Sempervivum vellavum* Index Kewensis (1895) (*nom. inval.*, Art. 32.1c); **incl.** *Sempervivum rupestre* Rouy & Camus (1901); **incl.** *Sempervivum vicentei* Pau (1906); **incl.** *Sempervivum chassegnei* Charbonnel (1913); **incl.** *Sempervivum latiusculum* Charbonnel (1913); **incl.** *Sempervivum leptcephalum* Charbonnel (1913); **incl.** *Sempervivum reflexifolium* Charbonnel (1913); **incl.** *Sempervivum tectorum* var. *rhenanum* Hegi & Schmid (1922) $\equiv$ *Sempervivum rhenanum* (Hegi & Schmid) Law (1956); **incl.** *Sempervivum aureggii* Lurani *ex* Correvon (1924); **incl.** *Sempervivum royanum* Correvon (1924); **incl.** *Sempervivum andreanum* Wale (1941) $\equiv$ *Sempervivum tectorum* var. *andreanum* (Wale) O. Bolòs & Vigo (1990).

[1] **L** glabrous or with a few scattered **Ha** on the surface.

S. thompsonianum Wale (Bull. Alpine Gard. Soc. Gr. Brit. 8: 210, 1940). **T:** K [+]. – **I:** Mitchell (1973: 25, pl. 6).

Most probably the hybrid *S. ciliosum* ssp. *octopodes* $\times$ *S. marmoreum* ssp. *reginae-amaliae*. Morphologically, it is intermediate between the alleged parents (shape of the rosettes and flower colour) and its pollen fertility is very low.

S. transcaucasicum Muirhead (Notes Roy. Bot. Gard. Edinburgh 26: 284-285, 1965). **T:** Georgia (Davis 33719 [E]). – **D:** NE Turkey (NE Anatolia), Georgia; rare, on igneous rocks, 550 - 2700 m.

Incl. *Sempervivum georgicum* Gurgendz (1965).

[1] **Ros** 3 - 4 cm $\varnothing$; stolons few, 2 - 3 cm; **L** oblanceolate to obovate, abruptly mucronate, shortly glandular-pubescent, yellowish-green, 15 - 20 $\times$ $\pm$ 10 mm; **Inf** cymose; **Fl** 11- to 13-merous, $\pm$ 2.5 cm $\varnothing$; **Sep** ovate-lanceolate, acute, 2 - 2.5 mm; **Pet** lanceolate, pale yellow, lavender at the base, 8 - 10 $\times$ $\pm$ 2 mm; **Fil** light purple; **Anth** yellow; **NSc** rectangular, upcurved.

Related to *S. artvinense*, *S. davisii* and *S. furseorum* according to Muirhead (1972: 247).

S. $\times$ vaccarii Wilczek *ex* Vaccari (Ann. Bot. (Roma) 3: 39, 1905).

$\equiv$ *S. arachnoideum* $\times$ *S. grandiflorum*.

S. $\times$ versicolor Velenovsky (Sitzungsber. Königl. Böhm. Ges. Wiss. Prag, Math.-Naturwiss. Cl. 27: 5, 1903).

$\equiv$ *S. marmoreum* $\times$ *S. ruthenicum*.

S. $\times$ wolfianum Chenevard (Bull. Trav. Soc. Bot. Genève 9: 130, 1887).

$\equiv$ *S. arachnoideum* $\times$ *S. grandiflorum* $\times$ *S. montanum* $\times$ *S. tectorum*.

S. wulfenii Hoppe *ex* Mertens & W. D. J. Koch (in Röhling, Deutschl. Fl., ed. 3, 3: 386, 1831). – **D:** E Alps; usually calcifuge, 1500 - 2700 m. **I:** Praeger (1932: 91); Lippert (1995: 87).

Incl. *Sempervivum globiferum* Wulfen (1778) (*nom. illeg.*, Art. 53.1).

[1] **Ros** open, 4 - 5 (-9) cm $\varnothing$; stolons few, long, stout, to 10 cm; **L** oblong-spatulate, cuspidate, greyish-green, dark purple basally, 20 - 40 $\times$ 10 - 15 mm, slightly glaucous, margins somewhat involute towards the tip, marginal cilia strongly glandular, absent in the upper part, younger **L** erect, gathered into a cone-shaped or bulb-like bud at the end of summer; flowering **Br** 10 - 30 cm, **L** deltoid-ovate, acute, clasping, spreading, $\pm$ 15 $\times$ 10 mm; **Inf** compact cymes with 3 short cincinni; **Fl** 10- to 15-merous, $\pm$ 2.5 cm $\varnothing$; **Sep** connate for up to 2 mm, acute, sometimes purple-tipped, $\pm$ 6 mm; **Pet** linear-lanceolate, acuminate, lemon-yellow, with a basal purple spot, $\pm$ 10 $\times$ 1 - 2 mm; **Fil** purple; **Anth** yellow; **Sty** $\pm$ 2 mm; **NSc** square, small. – *Cytology*: 2n = 36.

S. wulfenii ssp. **juvanii** (Strgar) Favarger & Parnell (Bot. J. Linn. Soc. 103(3): 217, 1990). **T:** Slovenia (Strgar s.n. [LJU]). – **D:** E Slovenia.

$\equiv$ *Sempervivum juvanii* Strgar (1971).

[1] **L** glandular-pubescent on both surfaces.

S. wulfenii ssp. **wulfenii** – **D:** E Switzerland, Austria, NE Italy. **Fig. XLIII.d, XLIII.f**

[1] **L** glabrous on both surfaces.

S. zeleborii Schott (Österr. Bot. Wochenbl. 7: 245-246, 1857). **T** [lecto]: Yugoslavia, Serbia (*Anonymus* s.n. [BP 148977]). – **Lit:** Jalas & al. (1999: 54). **D:** E Yugoslavia, N Grece, Bulgaria, W Romania; dry places in mountains. **I:** Praeger (1932: 81, fig. 23, lefthand plant); Mitchell (1973: 26, pl. 8).

[1] Shortly pubescent, **Ha** 0.4 - 0.7 mm; **Ros** $\pm$ globose, 3 - 5 cm $\varnothing$; stolons short; **L** oblong-obovate, shortly apiculate, grey-green, $\pm$ 20 $\times$ $\pm$ 8 mm; flowering **Br** 10 - 15 cm; **Fl** 12- to 14-merous, $\pm$ 25 mm $\varnothing$; **Sep** ovate to ovate-lanceolate; **Pet** bright yellow, lilac at the base, $\pm$ 9 $\times$ 1.5 mm; **Fil** purple; **Anth** yellow; **NSc** truncate or emarginate, $\pm$ spreading, < 0.2 mm. – *Cytology*: 2n = 64.

SINOCRASSULA

J. Thiede

Sinocrassula A. Berger (NPF2, 18a: 462, 1930). **T:** *Crassula indica* Decaisne [Lectotype, according to H. Ohba, J. Fac. Sci. Univ. Tokyo ser. 3, 12: 170, 1978.]. – **Lit:** Ohba (1978: 170); Fu & Fu (1984: 63-68); Chuang (1997). **D:** N India (Uttar Pradesh), Bhutan, E Tibet, SW China (Yunnan, Szechuan). **Etym:** Lat. 'sinensis' ['sino-'], Chinese; and for the flowers with a single whorl of stamens as in the genus *Crassula* (Crassulaceae).

Monocarpic succulent herbs, glabrous or papillose, rarely pubescent, annual, biennial or perennial, with reddish-brown thin striations or spots throughout; **R** fibrous; **Ros** to 10 cm Ø, but normally much smaller, with $\pm 10 - 70$ **L** (= basal **L** of flowering stems), often disintegrating at anthesis; **L** mostly alternate, rarely opposite, sessile, spurless, fleshy-succulent, obtuse to acuminate, (8-) 15 - 40 (-60) $\times$ (2-) 5 - 12 (-25) mm, often $\pm$ mottled; **Inf** (= flowering stem) erect throughout, $\pm 4 - 30$ (-60) cm at anthesis, scape simple, terete, scape **Bra** remote, **Inf** terminal (or rarely lateral), corymbose, simple to more richly branched, lateral part-**Inf** axes usually long-elongate, usually many-flowered; scape and floral **Bra** mostly alternate, rarely opposite, sessile, spurless, fleshy-succulent, entire, $\pm$ similar to the **Ros** leaves but smaller and diminishing in size upwards; **Ped** shorter to longer than the **Fl**; **Fl** hermaphrodite, 5-merous, haplostemonous, campanulate-urceolate in outline, 1.6 - 6 mm; **Sep** $\pm$ fleshy, basally connate, erect, persistent at **Fr** time, spurless, boat-shaped, 1.4 - 3 (-5) $\times$ 0.5 - 1.5 mm, green; **Pet** free, erect, $\pm$ oblong to lanceolate, fleshy, $\pm$ urceolately connivent, mostly longer than the **Sep**, rarely shorter, lobes reflexed, $\pm$ whitish to greenish or rose, $\pm$ intensely mottled with red, orange or brown; **St** 5, alternating with the **Pet**; **Fil** mostly slightly broadened, 1.3 - 3 mm; **Anth** basifixed, 2-locular, 0.7 - 1 mm, yellow; **NSc** $\pm$ square-oblong, mostly broader than long, 0.3 - 0.6 $\times$ 0.5 - 0.7 mm, cream-yellow; **Ca** superior, basally connate, erect throughout, ventrally not gibbose, rather broad, (1.5-) 2.5 - 4.5 mm; **Sty** abruptly narrowed, slender, short, 0.5 - 1.5 mm, slightly swollen at the tip; **Fr** erect follicles; **Se** cylindrical, $\pm 0.5 - 1.2$ mm, $\pm$ brown, with $\pm 10 - 15$ parallel longitudinal ribs. – **Cytology:** $x = 12$.

Sinocrassula is best characterized by the haplostemonous $\pm$ urceolate flowers in corymbose inflorescences and the small monocarpic rosulate habit.

Earlier, the genus was regarded as a close relative of *Sedum* or was even included in that genus, e.g. by Fröderström (1931). With its rosulate habit, *Sinocrassula* resembles the genus *Prometheum*, which is now again separated from *Sedum* by Ohba (1978) and 't Hart (1995). However, *Prometheum* differs clearly by diplostemonous non-urceolate flowers with ventrally papillate carpels and spreading fol-

licles as well as nearly smooth seeds (Ohba 1978). Molecular data of 't Hart (1995) and Ham & 't Hart (1998) place it clearly apart from *Sinocrassula*. These molecular data and the data of Mort & al. (2001) indicate a placement of *Sinocrassula* in subtribe *Telephiinae*, where the genus forms a well-defined clade together with *Orostachys* and *Hylo-telephium*. All these genera share a chromosome number of $x=12$. Within this clade, *Sinocrassula* is closely related to *Orostachys*. 't Hart (1995) even suggests to reduce *Sinocrassula* to a subgenus of *Orostachys*, but this was not followed up in any treatment. *Orostachys* differs clearly from *Sinocrassula* in its strictly biennial rosettes elongating into a terminal inflorescence with distinct main axis and its diplostemonous flowers with subconnate petals opening horizontally, as well as by stipitate and thus completely free carpels forming beaked follicles (see Ohba (1978) and Fu & Ohba (2001)). *Sinocrassula* and *Orostachys* are possibly linked by the 2 haplostemonous species of *Orostachys* Sect. *Schoenlandia*, which were earlier transferred to *Sinocrassula* by Berger (1930) and Fu (1965), although this was not followed by later authors. Since both species also differ from *Orostachys* s.str., they have also been separated at generic rank as *Kungia* (Fu & Ohba 2001). For the time being, *Orostachys* and *Sinocrassula* are accepted as traditionally circumscribed, but their relationships and delimitation need further study.

All taxa of *Sinocrassula* here treated (except the recently described *S. diversifolia* and *S. techinensis*) have been included as varieties within the very variable and widespread complex of *S. indica* by former authors, such as Ohba (1978) who only recognizes *S. ambigua* as a species of its own. The present treatment follows the most recent overview for the Chinese Flora by Fu & Fu (1984) and Fu & Ohba (2001), which separate the more distinct variants at species level.

When cultivated under dry and sunny conditions, the plants remain compact and delicately coloured. More ample watering may lead to lax and 'dissolved' rosettes, but results in the production of many inflorescences (Stephenson 1994).

S. ambigua (Praeger) A. Berger (NPF2 18a: 463, 1930). **T:** China, Yunnan (*Kingdon Ward* 391 [E]). – **D:** W China (Yunnan, Szechuan); open dry rocks and slopes, 2000 - 2800 (-3630 m), flowers May to September. **I:** Praeger (1921b: t. 170: 1).

$\equiv$ *Sedum ambiguum* Praeger (1921) $\equiv$ *Sedum indicum* var. *ambiguum* (Praeger) Hamet (1929).

Glabrous perennials; stems 3 - 6 cm, slender, 3 mm Ø, ascending, with sterile lateral **Br** at the base; **L** alternate or opposite at the stem base, crowded, sessile, flat, very fleshy, orbicular or orbicular-obovate or orbicular-rhomboid, tip rounded or apiculate, 9 - 12 $\times$ 9 - 12 mm, conspicuously silvery on both faces when dry; **Inf** corymbose, erect, simple,

slender, sparsely bracteolate, 5 - 15 cm, floriferous part 1.2 - 2.5 × 2.5 - 4 cm; **Bra** like the **L** but smaller; **Ped** mostly longer than the **Fl**, rose, purple when dry; **Fl** narrowly campanulate, 4 mm; **Sep** free, erect, oblong-linear, obtuse, (2.5-) 3 - 4.5 × 0.75 - 1 mm, intensely mottled with bright red; **Pet** erect, ovate-deltoid, mostly shorter than the **Sep** or rarely of the same length, 2.5 - 3 × 1 mm, bright rose, purple when dry; **Fil** 1.3 mm; **Anth** 0.7 mm; **NSc** minute, semi-elliptic, 0.5 × 0.5 mm; **Ca** robust, erect, 1.5 - 2 mm; **Sty** short, erect; **Se** 0.8 mm.

S. ambigua recalls *S. indica* var. *forrestii* in its leaf shape, but differs from *S. indica* s.l. in its oblong sepals at least equalling the petals. See Nelson (1994) on the typification of the species.

S. densirosulata (Praeger) A. Berger (NPF2 18a: 463, 1930). **T**: not typified. – **D**: SW China (Yunnan, Szechuan); flowers in July. **I**: Praeger (1921a: fig. 170, as *Sedum indicum* var.); Fu & Fu (1984: 62); Stephenson (1994: 185). **Fig. XLIV.a**

≡ *Sedum indicum* var. *densirosulatum* Praeger (1919); **incl.** *Lenophyllum maculatum* hort. (s.a.) (*nom. inval.*, Art. 29.1).

Ros dense, 2× as broad as tall, 2 - 4.5 cm Ø; **L** numerous, glabrous, narrowly spatulate, apiculate, 1 - 2.5 × 0.6 - 0.9 cm, very grey, dark olive-green or glaucous, heavily mottled with brown-red intricate markings, tipped purple; **Inf** short, 4.5 - 10 cm, broadly rounded, dense, richly branched almost from the base; **Ped** as long as the **Fl**; **Sep** green, 2.5 × 0.8 mm, intensely mottled with red; **Pet** suddenly thickened in the middle, 4 × 1 - 1.2 mm, yellow-green, strongly mottled with red; **NSc** narrow; **Se** 1.2 mm.

Chuang (1997) transfers this species into the synonymy of *S. indica*. Nelson (1994) discusses possible types for this name. It is the only species of the genus more frequently seen in cultivation, together with *S. yunnanensis*.

S. diversifolia H. Chuang (Acta Bot. Yunnan. 19(3): 224-225, 1997). **T**: China, Yunnan (Feng 24610 [KUN]). – **D**: W China (Yunnan); 2500 - 2700 m.

Glabrous; **R** numerous, fibrous, to 13 cm; **Ros** lax; **L** broadly obovate, broadly cuneate at the base, tip rounded, 30 - 40 × 20 - 25 mm, densely brown-maculate on both faces; **Inf** corymbose, simple, erect, robust, 40 - 50 cm, scape 4 - 6 mm Ø at the base, grey-green, densely purple-maculate, floriferous part 6 - 15 × 8 - 12 cm, **Br** winged; scape **Bra** alternate, dimorphic, lower **Bra** obovate or broadly elliptic, 3 - 5 × 2 - 2.7 cm, densely purple-maculate on both faces, upper **Bra** narrowly lanceolate or linear-lanceolate, 3 - 5 × 0.3 - 0.8 cm, sparsely purple-maculate on both faces, floral **Bra** similar but smaller; **Ped** erect, winged; **Sep** erect, triangular-lanceolate, tip acute or acuminate, 2 - 2.5 × 1 - 1.5 mm; **Pet** lanceolate, acuminate, 3.5 - 4 × 1 - 1.5

mm, yellow, upper face purple-maculate; **Fil** ± 1.7 - 2.2 mm; **Anth** ± 0.8 mm; **NSc** broadly square, 0.3 - 0.5 × 0.5 - 0.7 mm; **Ca** erect, 2.5 - 3 mm; **Sty** slender, 0.5 - 1 mm; **Se** ovate-oblong, with 10 - 12 parallel longitudinal costae, brown.

The species is clearly closely related to *S. indica* (Fu & Ohba 2001).

S. indica (Decaisne) A. Berger (NPF2 18a: 463, 1930). **T**: not typified. – **Lit**: Ohba (1992). **D**: Pakistan, N India (Uttar Pradesh: Kumaon, Garhwal), Nepal, Sikkim, Bhutan, China; 450 - 4000 m.

≡ *Crassula indica* Decaisne (1858) ≡ *Sedum indicum* (Decaisne) Hamet (1912); **incl.** *Sempervivum multiflorum* Jacquemont (1844).

This species exhibits an extremely wide range of variation, esp. in vegetative features (Ohba 1992). The varieties provisionally upheld here may possibly represent characteristic local or regional variants or partly even horticultural selections only, and Chuang (1997), e.g., does not recognize any infra-specific taxa. *S. indica* is a widespread and very variable complex in need of a more detailed study throughout its range.

S. indica var. *forrestii* (Hamet) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 113, 1965). **T**: China, Yunnan (*Forrest* 924 [E?]). – **D**: W China (Yunnan); dry clefts or rocky and shady cliffs, 1000 - 3000 m, flowers November.

≡ *Sedum indicum* var. *forrestii* Hamet (1912) ≡ *Sinocrassula luteorubra* var. *forrestii* (Hamet) H. Chuang (1997) (*nom. inval.*, Art. 33.2).

Differs from var. *indica*: **L** ovate-suborbicular, very broad, margin entire; **Inf** 30 - 60 cm; **Pet** yellow.

S. indica var. *indica* – **D**: Pakistan, N India (Uttar Pradesh: Kumaon, Garhwal), Nepal, Tibet, Sikkim, Bhutan, China; 450 - 4000 m, flowers April to October. **I**: Praeger (1921a: fig. 167-168); Stephenson (1994: 185). **Fig. XLIV.b**

incl. *Sedum paniculatum* Wallich (1828) (*nom. inval.*, Art. 32.1c); **incl.** *Sedum scallanii* Diels (1905); **incl.** *Sedum cavaleriei* H. Leveillé (1908); **incl.** *Sedum martinii* Leveillé (1908); **incl.** *Sedum scallanii* var. *major* hort. (1910) (*nom. inval.*, Art. 29.1?); **incl.** *Sedum indicum* var. *genuinum* Hamet (1912) (*nom. inval.*, Art. 24.3); **incl.** *Sedum cavaleriense* H. Leveillé (1915) (*nom. inval.*, Art. 61.1); **incl.** *Sedum paniculatum* var. *indicum* Hamet (1924) (*incorrect name*, Art. 11.4); **incl.** *Sedum indicum* var. *silvaticum* Fröderström (1936).

Ros usually glabrous, biennial, to 10 cm Ø but mostly smaller; **L** glabrous, linear-spatulate to clavate, long-apiculate, shortly pointed, much thickened, lower face convex, upper face flat, somewhat broader near the tip, or gradually narrowing, occasionally suborbicular, 1 - 4 (-6) × 0.6 - 1.5 cm, somewhat greyish or bluish-green, with dense red

or red-brown punctate or lineolate mottling; **Inf** glabrous, sparsely leafy, (5-) 10 - 30 (-60) cm, several times dichotomously branched, **Br** suberect or spreading, all attaining about the same level, upper parts glabrous or finely papillose, floriferous part $\pm$ 5 - 10 $\times$ 5 - 10 cm; **Ped** longer than the **Fl**, $\pm$ 0.6 - 1.2 cm; **Sep** deltoid, short, 1.5 - 2 (-3) $\times$ 0.5 - 1 mm; **Pet** suddenly thickened above the middle, 3 - 4 (-5) $\times$ 1 - 2 mm, whitish to whitish-green, stippled with red; **Ca** 2.5 - 3.5 mm; **Sty** mostly short, occasionally markedly long.

Rarely cultivated except in Japan (Stephenson 1994). Plant material was distributed by ISI in 2001.

S. indica var. **luteorubra** (Praeger) S. H. Fu (Fl. Reipub. Popul. Sin. 34(1): 68, 1984). **T:** China, Yunnan (Forrest 13377 [E]). – **D:** SW China (Yunnan, Szechuan); open dry situations amongst rocks and boulders, 700 - 3700 m, flowers July to August. **I:** Praeger (1921b: 85, as *Sedum*).

$\equiv$ *Sedum indicum* var. *luteorubrum* Praeger (1921) $\equiv$ *Sinocrassula luteorubra* (Praeger) H. Chuang (1997) (*nom. inval.*, Art. 33.2); **incl.** *Sedum paoshingense* S. H. Fu (1965) $\equiv$ *Sinocrassula paoshingensis* (S. H. Fu) H. Ohba & al. (2000); **incl.** *Sinocrassula paoshingensis* var. *spinulosa* H. Ohba & al. (2001).

Differs from var. *indica*: Stems, **Ped**, outer face and margins of the **Sep** and **Pet** tips shortly papillose; **Ros** with 10 - 18 **L**; **L** 15 - 25 $\times$ 8 - 12 mm; **Inf** simple, erect, 10 - 25 cm, red, finely and shortly papillose, floriferous part 3.5 - 6.5 $\times$ 4 - 6.5 cm; **Fl** larger, oblong, 6 mm; **Sep** larger, 4 - 5 $\times$ 1.5 mm, red; **Pet** lanceolate, acuminate, larger, 5 - 6 $\times$ 1.5 - 1.7 mm, pale yellow, red-tipped; **Ca** longer, (3-) 4 - 4.5 mm; **Sty** longer, $\pm$ 1.5 mm.

Chuang (1997) recognizes this taxon as a separate (but invalidly published) species, *S. luteorubra*, under which he also includes var. *forrestii* and var. *maculosa*.

S. indica var. **maculosa** H. Chuang *ex* Thiede (CSJA 71(3): 160, 1999). **T:** China, Yunnan (Wang 81964 [KUN]). – **D:** W China (Yunnan); 1250 - 2100 m, flowers August to December.

Incl. *Sinocrassula luteorubra* var. *maculosa* H. Chuang (1997) (*nom. inval.*, Art. 43.1).

Differs from var. *indica*: **Sep** 2 - 2.5 mm; **Pet** 3 - 3.5 mm; **Sep** and **Pet** intensely glandular-maculate.

Since Chuang described his var. *maculosa* under an invalidly published species name, the variety was validated by Thiede (1999), who follows the species concept of Fu & Fu (1984), under *S. indica*.

S. indica var. **obtusifolia** (Fröderström) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 113, 1965). – **D:** SW China (NW Yunnan, W Szechuan); 2300 - 2500 m, flowers July.

$\equiv$ *Sedum indicum* var. *obtusifolium* Fröderström (1931).

Differs from var. *indica*: **Ros** very dense and broad; **L** obtuse at the tip, smaller, 8 - 12 $\times$ 3 - 3.5 mm; **Inf** 8 - 9 cm; **Sep** 1.4 - 2 mm; **Pet** 3.5 - 4 mm, reddish.

Chuang (1997) lists this variety in the synonymy of *S. indica*.

S. indica var. **paniculata** Singh & Bhattacharyya (J. Econ. Taxon. Bot. 6(1): 211, ill., 1985). **T:** India, Uttar Pradesh (*Bhattacharyya* 33695 [BSD]). – **D:** India (Uttar Pradesh: Garhwal, Kumaon), 1600 - 1800 m, flowers July to August.

Differs from var. *indica*: **Inf** simple, unbranched, paniculate, lax, 4 - 12 $\times$ 3 - 8 cm; **Fl** very small, 1.6 - 4 $\times$ 1.1 - 2.5 mm; **Pet** pinkish-yellow.

This taxon might possibly be identical with the invalidly described *Sedum paniculatum* Wallich (1832).

S. indica var. **serrata** (Hamet) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 113, 1965). – **D:** China (Yunnan: between Tachienlu and Chlutu).

$\equiv$ *Sedum indicum* var. *serratum* Hamet (1927); **incl.** *Sinocrassula bergeri* H. Jacobsen (1955).

Differs from var. *indica*: **L** papillose-hairy (but **Inf** and **Fl** glabrous), obtuse, tip serrate-acuminate; **Inf** 5 - 10 cm.

S. indica var. **viridiflora** K. T. Fu (Fl. Tsinling. 1(2): 406-407, fig. 350; Addit., 606, 1974). **T:** China, Shaanxi (*Kou* 2195 [WUG?]). – **D:** W China (Henan, S Shaanxi, N Sichuan); on rocks, 500 - 600 m, flowers September.

Differs from var. *indica*: **L** 2.5 - 4 $\times$ 0.5 - 0.8 cm; **Pet** $\pm$ 2.5 mm, greenish-yellow; **NSc** 0.5 $\times$ 0.7 mm; **Ca** 3 - 4.5 mm.

Possibly very close to *S. densirosulata*.

S. longistyla (Praeger) S. H. Fu (Acta Phytotax. Sin. 10(Addit. 1): 112, 1965). **T:** China, Yunnan (Wilson 3640 [K]). – **D:** W China (Yunnan); 1300 - 1600 m, flowering July to October. **I:** Praeger (1921b: t. 175).

$\equiv$ *Sedum longistylum* Praeger (1921) $\equiv$ *Sedum indicum* var. *longistylum* (Praeger) Fröderström (1931) $\equiv$ *Sinocrassula indica* var. *longistyla* (Praeger) H. Jacobsen (1973).

Glabrous annuals or biennials; **L** alternate (basal **L** opposite), elliptic, $\pm$ 15 $\times$ 5 mm; **Inf** erect, much branched, 20 - 25 cm, **Br** long (to 10 cm), diverging, simple, their flowering parts dense, 1 $\times$ 1.5 cm; floral **Bra** few, flat, ovate, shortly acuminate, 2 - 3 mm; **Ped** shorter than the **Fl**; **Sep** 1.5 - 2.5 mm, lobes oblong-deltoid, obtuse, unequal, 1.5 - 2.5 $\times$ 1 - 1.25 mm, green; **Pet** oblong-deltoid and acute or oblong-ovate and acuminate, 3.5 - 4 $\times$ 1.25 mm, upper part deep red to purple; **St** 3 mm; **Fil** basally gradually broadened; **NSc** minute, $\pm$ 0.6 $\times$ 0.75 mm; **Ca** erect, 3 mm; **Sty** slender, recurved, $\pm$ 1.5 mm.

This species is best characterized by its habit and

the small dense inflorescences with purple flowers with long slender styles.

S. techinensis (S. H. Fu) S. H. Fu (Fl. Reipub. Popul. Sin. 34(1): 65, 1984). **T:** China, Yunnan (Wang 70378 [PE ?]). – **D:** W China (Yunnan); on rocks, 2700 m. **I:** Fu & Fu (1984: 62).

≡ *Sedum techinense* S. H. Fu (1951).

Glabrous, rarely very shortly hairy; **Ros** with 7 - 10 **L**; **L** linear or lanceolate, alternate, 15 - 26 × 2 - 5 mm; **Inf** broadly corymbose, simple, erect, 7 - 10 cm; **Sep** lanceolate, tip obtuse, all of equal length, 2 - 4 mm; **Pet** oblong, spurred, tip acute, 4 - 5 mm, recorded as red by the collector of the type but apparently yellow when dry; **Fil** 3 mm; **Anth** 1 mm; **NSc** almost square or broader, 0.4 × 0.6 mm; **Ca** erect, almost free to the base, ± 4 mm; **Se** ovoid, with ± 15 ribs, 0.5 mm.

Chuang (1997) transfers the species into the synonymy of *S. indica*.

S. yunnanensis (Franchet) A. Berger (NPF2 18a: 463, 1930). – **D:** W China (Yunnan); 2500 - 2700 m, flowers September. **I:** Praeger (1921a: fig. 169); Stephenson (1994: pl. 45).

≡ *Crassula yunnanensis* Franchet (1896) ≡ *Sedum indicum* var. *yunnanensis* (Franchet) Hamet (1913); **incl.** *Sedum pyramidale* Franchet *ms. ex* Hamet (1929) (*nom. inval.*, Art. 34.1c); **incl.** *Sedum pyramidalatum* Franchet in *sched. ex* Hamet (1929) (*nom. inval.*, Art. 34.1c).

Ros dense, 2.5 - 3.75 cm Ø, with 50 - 70 **L**; **L** oblanceolate to spatulate, almost terete, very thick, lower face very convex, upper face somewhat flat to convex, acute or acuminate, gradually mucronate, 12.5 - 25 × 4.5 - 6 mm, dark bluish-green, with dense purple mottling, turning black in full sun, densely pubescent with short white **Ha** esp. on young **L** and over both faces (or at least in the upper part and on the margins), **Ha** linear-deltoid, patent or slightly deflexed; **Inf** dense, flattish, densely leafy, 5 - 10 × 4 - 5 cm, finely papillose, lower **Br** opposite but few; **Ped** very short, shortly pubescent or papillose; **Fl** to 6 mm, narrowed towards the **Inf** tip; **Sep** rather narrow, 1.8 × 1 mm, papillose; **Pet** oblong-lanceolate, not thickened, more erect at the base (so that the **Fl** are rather narrow), 3 - 4 × 1.5 mm, light yellowish, with orange-red flush in full sun, papillose on the outside; **Ca** slender.

More frequently seen in cultivation. It may be hardy outdoors in mild climates (Stephenson 1994).

THOMPSONELLA

U. Eggli

Thompsonella Britton & Rose (CUSNH 12(9): 391, 1909). **T:** *Echeveria minutiflora* Rose. – **Lit:** Moran (1992b). **D:** C and S Mexico; mostly on limestone. **Etyim:** For Prof. Charles H. Thompson

(1870 - 1931), US-American botanist at the Missouri Botanical Garden and later at the Massachusetts College.

Perennial glabrous herbs or subshrubs; **Ros** stemless or almost so, ± flattish, to 42 cm Ø with 10 - 25 subclasping **L**; **L** each with 3 major and several minor ± parallel veins, thick-fleshy, flat or ± to strongly channelled, often glaucous, margins straight or wavy; **Inf** lateral, narrow thyrses or spicate above or as a whole, erect, ± massive, with 10 - 70 1- to 12-flowered cincinni; **Fl** sessile or almost so, 5-merous, obdiplostemonous, scentless; **Sep** free, erect to ascending, (sub-) equal, clavate, not spurred; **Pet** thin-textured, shortly connate basally, imbricate in bud, spreading from the middle, outside paleish, inside with dark confluent purplish-red blotches and lines on pale yellowish background, with narrow yellowish margins; **St** 10, erect; **Ca** shortly stipitate, basally shortly united; **Sty** slender; **Fr** erect follicles; **Se** numerous, pale yellowish-brown, shiny, reticulate with irregular longitudinal rows.

A small group of immediately recognized plants without obvious close affinities among other Mexican *Crassulaceae*. Intergeneric hybrids are known with *Cremnophila* (= ×*Cremsonella*), *Echeveria* (= ×*Thompsoveria*), *Graptopetalum* (= ×*Grapsonella*), *Pachyphytum* (= ×*Thompsophyllum*), and *Sedum* (= ×*Thompsosedum*).

T. colliculosa Moran (CSJA 64(1): 41-43, ill., 1992). **T:** Mexico, Michoacán (Moran 10150 [SD 53453, CU, HNT, SD]). – **D:** Mexico (E Michoacán); deciduous tropical woodland, 700 m. **Fig. XLIV.c**

R narrowly thickened to 6 mm Ø, caudex to 8 × 0.9 - 1.3 cm Ø; **Ros** flattish, 15 - 42 cm Ø with 12 - 20 **L**; **L** turgid, elliptic-oblanceolate, acute, 10 - 27 × 3.5 - 7 cm, brownish-green with paler lower face, not glaucous, ± channelled, epidermis rough, irregularly low papillose, margin acute, straight or slightly wavy; **Inf** 25 - 60 cm, scape 5 - 6 mm Ø, pale green, lower 4 - 5 cm **L**-less, otherwise with 10 - 45 ascending often bifurcate cincinni with 6 - 12 **Fl**; **Ped** ≤ 1 mm; **Sep** ± unequal, 6 - 7 × 2 mm, thickened upwards.

Distinct by the irregularly papillate roughened leaves.

T. minutiflora (Rose) Britton & Rose (CUSNH 12(9): 392, t. 44, 1909). **T:** Mexico, Puebla (*Pringle* 7500 [US 316776]). – **D:** S Mexico (Guerrero, México, Morelos, Oaxaca, Puebla, Veracruz?); often on limestone, 1650 - 2250 m. **I:** CSJA 41: 173-175, 1969. **Fig. XLIV.e**

≡ *Echeveria minutiflora* Rose (1903); **incl.** *Thompsonella glauca* Hort. Beisel (s.a.) (*nom. inval.*, Art. 29.1); **incl.** *Echeveria tepeacensis* von Poellnitz (1935); **incl.** *Graptopetalum mexicanum* Matuda (1956).

R carrot-shaped, to 1.3 cm Ø; **Ros** 3 - 17 cm, flat, with 10 - 20 ± deciduous **L** and perennial caudex 2 × 0.5 - 1 cm Ø; **L** elliptic to oblanceolate or narrowly obovate, acute to rounded, often apiculate, 2 - 10 × 1 - 2.5 cm, dark green, ± spotted or tinged with purple, first glaucous, later glabrescent, channelled to ± folded lengthwise, margins (sub-) acute, straight or crisped; **Inf** erect, 5 - 35 cm, scape 2 - 4 mm Ø, glaucous, floriferous for most of its length, racemose with 20 - 70 cincinni of 2 - 7 crowded **Fl**; **Ped** ≤ 0.5 mm, to 1 mm Ø, bibracteolate; **Sep** (sub-) equal, 4 - 7 × 1.5 - 3 mm; **Cl** glaucous; **Pet** erect below, spreading above, oblong to elliptic, acute, 3.5 - 5.5 × 1.5 - 2.25 mm, slightly keeled.

T. mixtecana Reyes & L. López (Cact. Suc. Mex. 43(2): 27-30, 48, ill., 1998). **T**: Mexico, Oaxaca (Reyes 3870 [MEXU, ENCB]). – **D**: Mexico (Oaxaca); tropical deciduous forests, 1700 m.

Subshrubs to 30 cm tall with fibrous **R**; stems 7 - 9 mm Ø, with papery peeling bark; **Ros** at stem tips, 5 - 7 cm Ø, with 8 - 10 **L**; **L** oblanceolate to obovate, 4 - 4.7 × 1.2 - 1.5 cm, flat, lower face carinate, mucronate, slightly pruinose; **Inf** 1 - 2, from below the **Ros**, glaucous-grey, 11 - 46 cm tall, paniculate with 16 - 28 cincinni with 2 - 6 **Fl** each; sterile **Bra** scaly, spurred, 18 - 21 × 5 - 7 mm, early caducous, fertile **Bra** smaller; **Ped** 1 - 3 mm; **Sep** unequal, olive-green to grey, clavate, 2 - 3.5 mm; **Fl** 5.5 × 3.5 mm Ø; **Pet** basally united to form a 2 mm long cream-coloured tube, tips stellately spreading, 4 - 6 × 1.5 - 2 mm, wine-red except the pale margins.

Similar in size to *T. xochipalensis*, but distinguished by the branching habit and the leaf shape.

T. platyphylla Rose (CUSNH 12(9): 392, t. 45, 1909). **T**: Mexico, Guerrero (Pringle s.n. [US 574982, BH, NY, US]). – **D**: Mexico (Guerrero, Puebla). **Fig. XLIV.d**

≡ *Villadia platyphylla* (Rose) E. Walther (1938); **incl.** *Echeveria planifolia* A. Berger (1930).

Very similar to *T. minutiflora*, but **R** not thickened; **Ros** short-stemmed to 7 cm, with 15 - 25 flat ± perennial **L**; **L** elliptic-oblong, 5 - 9 × 1.8 - 3 cm, thick, smooth, glaucous when young, flat or ventrally channelled; **Inf** thyrses, 23 - 46 cm, with 32 - 70 cincinni.

Probably not distinguishable from *T. minutiflora* (Kimmach 1993).

T. spathulata Kimmach (CSJA 65(1): 41-43, ill., 1993). **T**: Mexico, Oaxaca (Lau s.n. [HNT, MEXU]). – **D**: Mexico (Oaxaca). **Fig. XLIV.f**

R not described; **Ros** 5 - 8 cm Ø, solitary or rarely offsetting, ± compact; stemless or with a stem to 2 cm, completely glabrous; **L** pinkish-white to pinkish-bronze, young ± glaucous, strongly spatulate, 3 - 4 (-5) × 1 - 2 cm, broadest 4 - 10 mm below tip, upper face ± flat, tip cuspidate, 2 - 3 mm, margins rounded; **Inf** 11 - 16 (-25) cm, suberect, ± glau-

cous, cincinni ± 5 mm; **Ped** 1 - 4 mm; **Sep** subequal, free, 3 × 1 mm; **Pet** spreading or reflexed from the middle, 5 × 2.25 - 2.75 mm.

Closely related to *T. minutiflora*.

T. xochipalensis Gual & al. (Acta Bot. Mex. 40: 38-40, ill., 1997). **T**: Mexico, Guerrero (Peralta & Gual 167 [IEB, MEXU]). – **D**: Mexico (Guerrero).

Shrublets to 22 cm (excl. **Inf**); stem unbranched, 4.5 - 5.5 mm Ø, decumbent to erect or pendent, greyish, with apical **Ros**; **L** densely arranged, narrowly lanceolate to ensiform, 1.5 - 6.5 cm × 2.5 - 5.5 mm, pointed, dorsally canaliculate, glabrous but slightly farinose when young, olive-green; **Inf** 16 - 33 cm, spikes or basally paniculate; **Bra** narrowly lanceolate, 1.5 - 2.5 cm, pointed; **Fl** 6 - 8 mm Ø; **Sep** and **Pet** farinose, **Pet** glaucous-purplish-red; **NSc** 7 × 8 mm, white.

Similar in size to *T. mixtecana*, which branches, however, and has different leaves.

×THOMPSOPHYTUM

U. Eggli

×**Thompsophytum** C. H. Uhl (CSJA 66(4): 179, 1994).

= *Thompsonella* × *Pachyphytum*. See Uhl (1994b) for a list of known hybrid combinations (none formally named).

×THOMPSOSEDUM

U. Eggli

×**Thompsosedum** C. H. Uhl (CSJA 66(4): 179, 1994).

= *Thompsonella* × *Sedum*. See Uhl (1994b) for a list of known hybrid combinations (none formally named).

×THOMPSONOVERIA

U. Eggli

×**Thompsonoveria** C. H. Uhl (CSJA 66(4): 177, 1994).

= *Thompsonella* × *Echeveria*. See Uhl (1994b) for a list of known hybrid combinations (none formally named).

TYLECODON

E. van Jaarsveld

Tylecodon Tölken (BT 12(3): 378, 1978). **T**: *Cotyledon calalioides* Linné fil. – **Lit**: Tölken (1985: 19-35). **D**: Namibia, RSA; winter rainfall regions, mainly Succulent Karoo. **Etym**: Anagram of the

genus name *Cotyledon* (Crassulaceae), where the species were formerly placed.

Perennial deciduous herbs or shrublets, usually with a caudiciform base, ranging from dwarf geophytes to pachycaul dwarf trees to 2.5 m tall; active growing season from autumn to early summer, flowering $\pm$ in summer; **R** fibrous or succulent; **Br** mostly short, ascending, succulent, sometimes scandent, brittle or tough and rarely woody, sometimes with persistent woody tubercles (phyllopodia); bark variable, smooth, rough, peeling in strips or flakes; **L** spirally, usually crowded at stem tips, flat, or terete and then often grooved on the upper face, withering during early summer and often completely deciduous; sometimes with modified **L** in the form of small spinescent **Bra** among the normal **L**; **Inf** terminal thyrses consisting of 1 to several monochasia, each with 1 to many spreading to erect **Fl**; **Fl** 5-merous, actinomorphic (zygomorphic in *T. grandiflorus*), obdiplostemonous; **Sep** $\pm$ appressed to the **Cl**, much shorter; **Cl** tubular to funnel-shaped; **Pet** fused for $\frac{3}{4}$ or more, lobes spreading, often becoming recurved, white, greenish, yellowish or mauve, rarely reddish; **St** 10; **Fil** fused to the lower part of the **Cl** tube; **Ca** 5, free, with erect **Sty** and basal **NSc**; **Fr** erect capsules, dehiscent apically only; **Se** very small, ellipsoid, costate (?), wind-dispersed.

The genus is rather closely related to *Cotyledon* and *Adromischus*, and has only comparatively recently been segregated from the former. Its main concentration of species is in the Richtersveld and the Knersvlakte in the Northern Cape and Western Cape provinces of RSA, from where several new taxa have recently been described.

Tylecodon are popular winter-growing and summer-flowering stem and leaf succulents which must be kept dry during summer. Species range from dwarf single-leaf geophytes to pachycaul dwarf trees to 2.5 m. Pollination is by insects (*T. grandiflorus* and *T. paniculatus* by sunbirds) (Gess 2001). Leaves wither for the summer period; they are either completely deciduous, or the basal thickened part remains as small stumpy tubercles, called phyllopodia. Propagation is by seed, division or stem cuttings.

T. albiflorus Bruyns (SAJB 55(3): 333-335, ill., 1989). **T**: RSA, Western Cape (*Bruyns* 1409 [NBG]). – **D**: RSA (Western Cape); Renosterveld, flowers from late spring to mid-summer.

Sparingly branched succulents to 6 cm tall and 14 cm $\varnothing$, with an underground tuber to 3.5 cm $\varnothing$; **Br** 1 - 3, erect to spreading, 1 - 3 cm long, main stem to 3 cm $\varnothing$, with yellowish-brown peeling bark exposing greenish tissue; **L** crowded in apical **Ros**, spreading to recurved, elliptic-spatulate to obovate, flat, 3 - 5.5 $\times$ 0.9 - 2.2 cm, glandular-hairy, base cuneate, apex obtuse, upper face grooved at the base; **Inf** erect to spreading thyrses 13 - 27 cm long with 1 - 3 monochasia each bearing 1 - 3 erectly spread-

ing **Fl**; peduncle glandular-pubescent, with spatulate **Bra** 5 mm long; **Ped** $\pm$ 12 mm; **Cl** tubular, 12 - 15 $\times$ 4.5 mm, green, outside glandular-pubescent; lobes 10 mm, white on the upper face.

T. atropurpureus Bruyns (SAJB 55(3): 332-333, ill., 1989). **T**: RSA, Northern Cape (*Bruyns* 2658 [BOL, PRE]). – **D**: RSA (Northern Cape: Namaqualand); Succulent Karoo, flowers in mid-summer.

Sparingly branched succulent geophytes with oblong underground caudex 15 $\times$ 5 cm; **R** tuberous with peeling grey bark; **Br** 2 - 6, 0.5 - 1 cm $\times$ 7 mm $\varnothing$ with short truncate phyllopodia; **L** crowded, flat, ascending, sparingly glandular-hairy, ovate to spatulate, to 8 $\times$ 6 cm, base cuneate, apex acute or obtuse; **Inf** erect thyrses, 15 - 37 cm, with 2 - 4 monochasia each with 8 - 20 erectly spreading **Fl**; peduncle to 28 cm, glandular-hairy; **Ped** 10 - 16 mm; **Cal** to 4.5 mm; lobes 3 mm, linear; **Cl** tubular, 12 - 14 $\times$ 5 mm, pale green, glandular-pubescent, lobes to 3 mm, spreading and becoming reflexed, dark black-purple on the upper face.

T. aurusbergensis G. Williamson & van Jaarsveld (Aloe 29(3/4): 60-62, ill., 1993). **T**: Namibia (*Williamson* 4417 [NBG]). – **D**: S Namibia; Succulent Karoo, flowers from mid- to late summer.

Sparingly branched erect succulents to 8 cm tall, with conical smooth to knobbly succulent caudex to 4 cm $\varnothing$ with grey peeling bark exposing green tissue; **L**-bearing **Br** 2 - 3 mm $\varnothing$, with short sharp **Bra**-like **L** to 0.5 mm; stem sparingly branched, with 1 to several erect succulent **Br** with grey bark and short truncate phyllopodia to 1 mm; **L** ovate to obovate-spatulate, 1.8 - 2 $\times$ 1.5 - 3.5 cm, crowded at **Br** tips, glandular-hairy, base cuneate, apex obtuse, upper face concave to channelled, lower face with maroon striations; **Inf** short almost sessile monochasia with 1 - 3 glandular-hairy erect **Fl**; peduncle 2 - 20 mm; **Ped** 2 - 3 mm; **Cl** tubular, $\pm$ 1 cm, tube light green, glandular-pubescent, lobes pink to pink-lilac, becoming recurved.

T. bayeri van Jaarsveld (Aloe 25(2): 30-32, ill., 1988). **T**: RSA, Northern Cape (*Bayer* 1492 [NBG]). – **D**: RSA (Northern Cape); Succulent Karoo, flowers from mid- to late summer. **Fig. XLV.b**

Incl. *Tylecodon mallei* G. Williamson (1995).

Dwarf sparingly branched scandent succulents to 20 cm $\varnothing$ from a $\pm$ globose tuberous base to 2.5 cm $\varnothing$ with grey-brown flaking bark; **Br** slender, to 18 cm $\times$ 2.5 mm $\varnothing$, grey, ribbed from the decurrent phyllopodia, often thickened partly and then rooting; phyllopodia 1 - 2 mm long, truncate, often recurved; **L** variable, spreading to recurved, often crowded at **Br** tips, 1.5 - 4 $\times$ 0.4 - 3.2 cm, glandular-hairy, flat, narrowly to broadly oblanceolate, ovate or elliptic, base cuneate, apex obtuse to acute; **Inf** flat-topped spreading to ascending thyrses to 4 cm tall with 1 - 2 monochasia, each bearing 1 - 3 er-

ect **Fl**; **Ped** 1 cm; **Cl** tubular, 10 - 12 × 4 mm, expanding slightly towards throat, yellow to brownish and covered with short **Gl**-tipped **Ha**, lobes spreading, becoming recurved.

T. bleckiae G. Williamson (CSJA 70(3): 127-128, ill., 1998). **T**: Namibia (*Bleck & Lavranos* s.n. in *Williamson* 5896 [NBG]). – **D**: RSA (Northern Cape: Lower Orange River), adjacent S Namibia; Succulent Karoo.

Dwarf succulent shrublets to 8 cm tall from an elongated spreading tuberous base, tubers to 7 × 3 cm; **Br** numerous, often tangled, usually unbranched, to 7 × 0.4 cm, ascending to spreading, grey with raised black flakes; **L** 3 - 7 in terminal **Ros**, 6 - 8 × 3 - 4 mm, elliptic, with a central groove on the upper face, dull green, glandular-hairy; **Inf** with 1 - 2 dichasia on an erect peduncle to 10 × 1.2 mm; **Sep** ovate-triangular, to 2.5 × 1.8 mm, glandular-pubescent; **Cl** cylindrical, 12 × 4.5 mm, pale green with spreading lobes becoming recurved, lobes ovate, acute, light red with dark pink to red streaks and white margins; **NSc** narrowly ovate, emarginate, cream-yellow.

Previously confused with *T. buchholzianus*.

T. bodleyae van Jaarsveld (CSJA 64(2): 57-61, (4): 168 [erratum], ill., map, 1992). **T**: RSA, Northern Cape (*Lavranos & Bleck* s.n. [NBG]). – **D**: RSA (Northern Cape); Succulent Karoo, steep quartzitic sandstone rock faces, flowers in late summer.

Dwarf erect sparingly branched succulents to 10 cm tall from a tuberous base to 6 cm Ø with yellow-brown peeling bark; **Br** ascending, grey-green, with dark longitudinal striations, articulated at the nodes, younger **Br** 4 - 5 mm Ø; phyllopodia short, truncate; **L** obovate to elliptic, 8 - 15 × 6 - 14 mm, green to pale green, sparingly glandular-hairy or glabrous, base cuneate, apex acute; **Inf** thyrses to 4 cm with 1 - 2 monochasia, each with 1 - 2 erect **Fl**; **Ped** 6 - 16 mm, glandular-pubescent; **Bra** linear, acute, 1 - 1.5 mm; **Sep** triangular-lanceolate 3 × 1 mm; **Cl** 11 - 15 mm, tube funnel-shaped, yellowish-green, 3 mm Ø at the base expanding to 4 mm at the throat, glandular-hairy, lobes oblong, 5 × 2.5 mm, spreading, becoming recoiled, with long **Ha** on the inner surface; **NSc** yellowish-green, oblong, erect, emarginate, 1 × 0.5 mm.

T. buchholzianus (Schuldt & Stephan) Tölken (BT 12(3): 379, 1978). **T**: RSA, Northern Cape (*Schlechter* s.n. [B †]). – **D**: S Namibia, RSA (Northern Cape). **Fig. XLV.c**

≡ *Cotyledon buchholtziana* Schuldt & Stephan (1937); **incl.** *Tylecodon buchholtzianus* hort. (s.a.) (*nom. inval.*, Art. 61.1).

Branched ascending succulent dwarf shrublets up to 30 cm tall with a spreading untidy irregular crown to 27 cm wide; **Br** grey-green, smooth, brittle, to 2 cm Ø at the base tapering to 3 - 5 mm

Ø; bark grey-green with small hollow **L** scars 1 - 2 mm wide; older **Br** with peeling bark in brown flakes, erect to spreading or rarely drooping when growing from overhanging rocks, sometimes remaining **L**-less and photosynthetic active for a long time; **L** short-lived, crowded, ascending to spreading, linear-terete to obovate (then dorsiventrally flattened and grooved above), 5 - 40 × 3 - 5 mm; **Bra**-like **L** reddish, subulate, 1 mm; **Inf** erect almost sessile thyrses to 2 cm with 1 - 3 dichasia each bearing 1 - 3 ± erect **Fl**; **Cl** tubular, purple to red-purple, 10 - 15 × 4 mm, lobes hairy on the inside, spreading, becoming recurved.

A very variable species with several local forms, but since these are intergrading, they are difficult to classify formally.

T. buchholzianus var. **buchholzianus** – **D**: S Namibia, RSA (Northern Cape); Succulent Karoo, flowers in mid- and late summer.

Description as for the species.

T. buchholzianus var. **fasciculatus** G. Williamson (Aloe 29(3/4): 62-63, ill., 1993). **T**: RSA, Northern Cape (*Williamson* 4420 [NBG, BOL]). – **D**: RSA (Northern Cape: Richtersveld, restricted to the Aughrabies Mts.); E aspects of quartz cliffs, flowers in mid-summer.

Differs from var. *buchholzianus*: Forming dense spreading to pendulous clusters with little or no **L**, **Br** becoming greenish during winter; **L** 1 - 2 per **Br**, very brittle and soon deciduous.

T. cacalioides (Linné *fil.*) Tölken (BT 12(3): 379, 1978). **T**: RSA, Western Cape (*Thunberg* s.n. [UPS [Herb. Thunberg 10998]]). – **Lit**: Tölken (1985: 35). **D**: RSA (Western Cape); Succulent Karoo, flowers in mid-summer.

≡ *Cotyledon cacalioides* Linné *fil.* (1781); **incl.** *Cacalia papillaris* Linné (1753) ≡ *Kleinia papillaris* (Linné) Haworth (1812) ≡ *Senecio papillaris* (Linné) Schulz-Bipontinus (1845) ≡ *Tylecodon papillaris* (Linné) G. D. Rowley (1979).

Ascending branched shrubs to 50 cm tall and with a single main **Br** to 5 cm Ø with yellowish-grey peeling bark; **Br** 15 - 18 mm Ø, grey-green with short phyllopodia 1 - 2 mm tall (often absent in older **Br**); **L** to 6.8 × 0.4 cm, crowded, glabrous (young glandular-hairy), grey-green, linear, subterete and curved inwards, upper face sometimes slightly grooved; **Inf** erect thyrses to 55 cm tall with up to 7 spreading monochasia; peduncle to 7 mm Ø at the base, glandular-hairy becoming glabrous; **Fl** spreading; **Ped** 7 mm; **Cl** 17 - 25 × 5 - 6 mm Ø, tubular and expanding upwards, sulphur-yellow with spreading lobes becoming recurved.

See Tölken (1985) on the application of the name *Cacalia papillaris*. The flowers are most probably pollinated by a long-proboscid horse-fly (Gess 2001).

T. cordiformis G. Williamson (CSJA 70(5): 255-258, ill., 1998). **T:** RSA, Northern Cape (*Hammer & Barnhill* s.n. in *Williamson* 5911 [NBG]). – **D:** RSA (Northern Cape); Succulent Karoo, flowers mid- to late summer.

Dwarf, sparingly branched, with an oblong tuberous base 5 × 2 cm Ø with grey-brown flaking bark; **Br** short, 5 - 45 × 4 - 8 mm, grey; phyllopodia triangular, covered in minute **Ha**; **L** 2 - 4 in terminal **Ros** with suberect to erect petioles to 8 mm, lamina dark shiny green, cordate, 5 - 8 × 7 - 10 mm, covered with dense erect white **Ha**; **Inf** flat-topped ascending thyrses to 1 cm tall; **Sep** 2 × 0.8 mm, rectangular, tip rounded; **Cl** tubular, 10 × 5 mm, expanding slightly towards the throat, lime-green, covered by dense **Ha**, lobes 4 × 2.5 mm, spreading, becoming slightly recurved; **NSc** transversely oblong, 0.5 × 0.8 mm, emarginate.

T. decipiens Tölken (BT 12(3): 379, 1978). **T:** RSA, Northern Cape (*Tölken* 5252 [PRE]). – **D:** S Namibia, RSA (Northern Cape); Succulent Karoo, flowers in late summer.

Dwarf mat-forming highly branched succulents with a tuberous base; **Br** 7 - 10 mm Ø, pale grey-green, smooth, without phyllopodia, densely intertwined, often forming dense cushions to 20 cm Ø; **L** 5 - 14 × 6 - 10 mm, oblanceolate, flat, glabrous, upper face flat to grooved, apex obtuse; **Inf** thyrses to 4 cm tall with 1 - 2 monochasia, each bearing 1 - 2 erect **Fl**; **Ped** 1 cm; **Sep** 2 - 3 mm, triangular-lanceolate; **Cl** tubular, 9 - 10 × 4 mm Ø, white to pink, lobes spreading, becoming recurved.

Deceptively similar to *T. schaeferianus*.

T. ellaphieae van Jaarsveld (FPA 50(2): t. 1983 + 3 pp. of text, 1989). **T:** RSA, Northern Cape (*van Jaarsveld & Drijfhout* 5523 [NBG]). – **D:** RSA (Northern Cape); Succulent Karoo, sheer quartzitic sandstone cliff-faces, mid-summer-flowering.

Incl. *Tylecodon cremnophilus* Bruyns (1990).

Dwarf sparingly branched succulents 1 - 6 cm tall with a tuberous base to 3 cm Ø; **Br** 2 - 8, ascending, grey, to 6 cm long with truncate phyllopodia to 2 mm; older **Br** with flaking yellowish-grey bark, **L**-bearing **Br** 5 mm Ø; **L** crowded, spreading, 2.3 - 4.5 × 1 - 2.8 cm, oblanceolate, ovate to spatulate, glandular-hairy, upper face channelled at the base, base cuneate, apex acute or obtuse; **Bra**-like **L** subulate, to 2 mm, persistent; **Inf** short flat-topped thyrses to 8 cm with 1 - 3 monochasia, each with 1 - 3 erect **Fl**; peduncle glandular-hairy; **Ped** 5 mm; **Cl** tubular, to 15 × 4 mm Ø, light green, slightly expanding towards the throat, lobes 6 × 3 mm, white, spreading, becoming recurved, acuminate.

T. faucium (von Poellnitz) Tölken (BT 12(3): 379, 1978). **T:** RSA, Western Cape (*Herre* s.n. in *SUG* 6841 [B †, BOL [clono]]). – **D:** RSA (Western Cape); Succulent Karoo, flowers in mid-summer.

≡ *Cotyledon faucium* von Poellnitz (1941).

Dwarf sparingly branched succulents with shallowly rooted stems and indistinct tuber; **Br** short, spreading, to 7 × 1 - 1.5 cm Ø, covered with short pointed phyllopodia 2 mm long, bark grey-green; **L** crowded, variable, mostly oblanceolate, obovate to spatulate, 1.5 - 3 × 0.5 - 1.2 cm, glandular-hairy, upper face grooved or flat, rarely lamina almost terete, often pinkish in colour; **Inf** spreading thyrses 15 - 30 cm of 1 - 3 monochasia; **Fl** erect; **Cl** funnel-shaped, 12 - 20 × 4 mm, yellowish-green, lobes spreading to recurved, pink to maroon, 6 × 3 mm.

T. ×fergusoniae (L. Bolus *pro sp.*) G. D. Rowley (KuaS 41(12): 282, 1990).

≡ *Cotyledon fergusoniae* L. Bolus (1931).

This represents the hybrid *T. cacalioides* × *T. paniculatus*.

T. fragilis (R. A. Dyer) Tölken (BT 12(3): 379, 1978). **T:** RSA, Cape Prov. (*Hall* 3426 [PRE, NBG]). – **D:** RSA (Northern Cape, Western Cape); Strandveld, Succulent Karoo, in rock crevices, summer-flowering. **Fig. XLV.a**

≡ *Cotyledon fragilis* R. A. Dyer (1971).

Low sparingly branched ascending succulents to 16 cm tall with tuberous base to 2.5 cm Ø with grey peeling bark; **Br** brittle, smooth, to 35 cm, 4 mm Ø, sometimes scandent, bark grey-white, with distinct or indistinct darker grey-green to black striae; **L** softly succulent, linear, terete to slightly flattened, 2.5 - 5 cm × 2 - 3 mm, slightly grooved on the upper face, apex obtuse to acute, mucronate; **Inf** thyrses 7 cm tall, with 1 - 4 monochasia each bearing 1 - 3 erect to ± spreading **Fl**; **Ped** ± 5 mm; **Sep** 2 mm, triangular-lanceolate; **Cl** yellowish-green, tubular, smooth, to 10 - 12 × 4 mm, slightly expanding towards the throat, lobes spreading, 5 × 2 mm, obtuse, becoming recurved.

T. grandiflorus (Burman *fil.*) Tölken (BT 12(3): 379, 1978). **T:** [icono]: Burman, *Rar. Afr. Pl.* t. 20, fig. 1, 1738. – **D:** RSA (Northern Cape, Western Cape); Strandveld, Renosterveld, Succulent Karoo, flowers in late summer.

≡ *Cotyledon grandiflora* Burman *fil.* (1768); **incl.** *Cotyledon tuberculosa* Lamarck (1786); **incl.** *Cotyledon curviflora* Sims (1819).

Low-growing sparingly branched succulents with decumbent **Br**, these with round obtuse phyllopodia 2 mm high, or smooth; bark grey to yellowish, peeling; **L** crowded, ascending, 6 - 14 × 0.6 - 1.5 cm, linear-elliptic to linear-oblanceolate, glabrous; upper face grooved to channelled, lower face convex, base tapering, apex obtuse; **Inf** ascending thyrses of 1 - 5 monochasia, to 60 cm; peduncle to 50 cm, 4 mm Ø at base; **Bra** linear, 10 - 12 mm; **Fl** spreading-ascending; **Ped** 3.5 - 4 cm; **Sep** linear-triangular, 7 × 2 mm, glandular-hairy; **Cl** curved-tubular,

slightly expanding towards the throat, 3 - 4 cm, orange-red, glandular-hairy.

The flowers are the largest in the genus.

T. hallii Tölken (BT 12(3): 379, 1978). **T:** RSA, Northern Cape (*Hall* 1300 [NBG]). – **D:** S Namibia, RSA (Northern Cape); Succulent Karoo, flowers in spring.

Incl. *Cotyledon hallii* Tölken (1977) (*nom. illeg.*, Art. 53.1).

Dwarf branched shrubs to 30 cm tall with thick main stem to ± 8 cm $\varnothing$, and rounded crown; **Br** 5 - 7 mm $\varnothing$; bark smooth, grey with darker spots in younger plants, on older **Br** darker and peeling; **L** glabrous or with few scattered glandular **Ha**, light green, crowded at **Br** tips, curved inwards, 15 - 25 $\times$ 3 - 4 mm, linear to linear-lanceolate, terete or almost so, base tapering, apex obtuse; **Inf** erect thyrses to 6 cm with 1 - 5 monochasia; **Fl** erect; **Ped** 5 - 7 mm; **Sep** to 9 mm, triangular; **Cl** tubular, slightly bulging at the base and broadening upwards, 10 - 20 $\times$ 5 mm, yellowish, glandular-hairy, lobes to 8 mm, spreading to recurved.

T. hirtifolius (W. F. Barker) Tölken (BT 12(3): 379, 1978). **T:** RSA, Northern Cape (*Herre* s.n. [BOL 22165]). – **D:** RSA (Northern Cape); Succulent Karoo on the Namaqualand escarpment, flowers in mid-summer.

$\equiv$ *Cotyledon hirtifolia* W. F. Barker (1938).

Low sparingly branched succulents 4 - 6 cm tall with spreading to decumbent **Br** to 17 cm with grey-black oblong phyllopodia 5 - 6 $\times$ 2 - 3 mm; **L** flat, green, obovate to oblanceolate, 4 - 10 $\times$ 2.3 - 3.5 cm, upper face concave, lower face convex, base cuneate, apex obtuse or acute; **Inf** thyrses to 75 cm with 2 - 3 ascending monochasia each with 5 - 10 yellowish-green spreading to $\pm$ nutant **Fl**; **Cl** 14 - 18 mm, campanulate, glandular-hairy, lobes white, recurved.

T. kritzingeri van Jaarsveld (JSAB 49(3): 305-310, fig. 2, 1983). **T:** RSA, Northern Cape (*van Jaarsveld & Kritzinger* 6278 [NBG]). – **D:** RSA (Northern Cape); Succulent Karoo, flowers in mid-summer.

Scandent sparingly branched succulents to 1 m tall from a tuberous base to ± 3 cm $\varnothing$; **R** tuberous, oblong, to 1 cm $\varnothing$; **Br** ascending, grey with darker striations, 3 - 4 mm $\varnothing$; **L** linear to linear-elliptic, 2 - 4 cm $\times$ 2 - 4 mm, glabrous, green, spreading, the obtuse or acute tips often recurved or recoiled to help in climbing, upper face grooved, lower face convex; **Inf** spreading thyrses, 20 cm, with 1 - 3 monochasia with 1 - 3 spreading to erect **Fl** each; peduncle to 18 cm, 1.5 mm $\varnothing$; **Ped** 1.2 - 2 cm; **Sep** glabrous, triangular-lanceolate, 5 $\times$ 2 mm, acute; **Cl** tubular, 20 $\times$ basally 4 mm $\varnothing$, gradually expanding to 7 mm at the throat, lobes 8 - 10 $\times$ 4 mm, spreading and becoming recurved, acute, upper face dark maroon to reddish.

T. leucothrix (C. A. Smith) Tölken (BT 12(3): 379, 1978). **T:** [lecto - icono]: *Bothalia* 3: t. 1, 1939. – **D:** RSA (Western Cape); Succulent Karoo, flowers late spring to mid-summer.

$\equiv$ *Adromischus leucothrix* C. A. Smith (1939) $\equiv$ *Cotyledon leucothrix* (C. A. Smith) Fourcade (1941); **incl.** *Cotyledon swartbergensis* von Poellnitz (1939).

Erect sparsely branched shrublets 5 - 18 cm tall; **R** fibrous; main stem solitary, 1.5 - 6.5 cm $\varnothing$, often markedly swollen, globose or irregular (often tuberous and partly underground), bark smooth, peeling, yellowish-grey, brown to purplish exposing the green to brown inner tissue; **L** 2.5 - 7.5 $\times$ 0.8 - 1 cm, crowded at stem tips, linear elliptic to narrowly lanceolate or oblanceolate, sometimes almost terete, glandular-hairy, upper face grooved to channelled, lower face convex, base cuneate, apex acute; **Inf** ascending thyrses, 10 - 34 cm, with 1 - 5 monochasia each with 1 - 3 erectly spreading **Fl**; peduncle 8 - 20 cm, 2 mm $\varnothing$ at base, glandular-hairy; **Ped** 5 - 25 mm; **Cl** tubular, 6 - 10 $\times$ 4 mm, lobes spreading, 3 - 4 mm, white or pink.

Plants from Joubert Kop in the Little Karoo have grey-white branches.

T. longipes van Jaarsveld & G. Williamson (Aloe 31(3-4): 56-58, ill., 1995). **T:** RSA, Northern Cape (*van Jaarsveld & al.* 13063 [NBG]). – **D:** RSA (Northern Cape); Succulent Karoo, flowers in mid-summer.

Dwarf highly branched mat-forming succulents to 3 cm tall and 20 cm $\varnothing$; **Br** to 2 cm $\varnothing$, with silver-grey bark cracking and exposing the green tissue; **L** 1 - 4 per **Br**, crowded, spreading, 1.5 - 3.5 $\times$ 1 - 2 cm, lanceolate or broadly ovate to spatulate, sometimes 3-lobed, glandular-hairy, with short petiole to 5 mm, rarely somewhat channelled, base cuneate, apex obtuse; **Bra**-like **L** subulate, 1 mm, soon deciduous; **Inf** thyrses to 3 cm with 1 - 3 monochasia; peduncle 1 - 2 cm, glandular-hairy; **Fl** erect; **Ped** 7 mm; **Sep** triangular, to 2 $\times$ 1 mm; **Cl** tubular, to 15 mm, tube cylindrical to funnel-shaped, green-white, lobes oblong, 4 - 6 $\times$ 2 mm; **St** exerted, 10 mm; **NSc** transversely rectangular, 0.7 mm.

T. nigricaulis G. Williamson & van Jaarsveld (Aloe 36(2-3): 43-44, ill., 2000). **T:** RSA, Northern Cape (*van Jaarsveld* 12802 [NBG]). – **D:** RSA (Northern Cape: near Garies); granite outcrops, Succulent Karoo.

Dwarf branched shrublets ± 8 cm tall and broad from a branched basal tuberous network; tubers carrot-shaped to oblong-rounded, to 15 - 35 mm long; stems thin, unbranched to sparingly branched from the base, to 70 $\times$ 3 - 4 mm, upper $\frac{2}{3}$ covered in low glossy black to blackish-brown phyllopodia; **L** in winter, 3 - 6 in terminal tight **Ros**, light green, narrowly elliptic, falcate with a shallow adaxial groove, distinctly apiculate, 12 $\times$ 4 mm, 2 mm

thick; **Inf** monochasia, to 25 × 17 mm with 3 - 5 **Fl**; peduncle erect, to 10 × 1 mm, terminal on previous year's growth, with glandular **Ha**; **Fl** 6 mm long; **Ped** greenish, wire-like, to 10 mm, covered in crystalline **Ha**; **Cl** tube cylindrical, pale canary-yellow to yellowish-green, 5 × 2.5 mm; **Cl** lobes spreading, oblong, apiculate, whitish to pale lilac, 3.2 × 1.5 mm; **NSc** bright yellow, rectangular, deeply emarginate.

Compared with *T. pygmaeus* in the protologue.

T. nolteei Lavranos (Piante Grasse 20(3): 124-126, ill., 2001). **T**: RSA, Western Cape (*Lavranos* 31258 [PRE, MO, P]). – **D**: RSA (Northern Cape); Succulent Karoo, shale cliffs, summer-flowering.

Dwarf succulent shrubs to 7 cm tall, little-branched, with a single main thickened stem to 2 cm Ø; **R** fibrous; stems with smooth slightly peeling bark, olive-green to brownish; **L** 2 - 5, sessile, orbicular to broadly elliptic, 10 - 25 × 7 - 22 mm, glaucous, hairy, with reddish pellucid markings; **Inf** erect thyrses to 4 cm with 2 to several monochasia, persistent for several seasons; **Ped** 3 - 15 mm; **Sep** triangular, 2 - 3 mm, hairy; **Cl** erect, tubular, cream-coloured to light pink, pubescent, 12 - 13 × 4 mm Ø, lobes spreading, 1.5 mm; **NSc** obtusely ovate.

Distantly related to *T. reticulatus* according to the protologue.

T. occultans (Tölken) Tölken (BT 12(3): 380, 1978). **T**: RSA, Western Cape (*Hall* 4289 [PRE, NBG]). – **D**: RSA (Western Cape); quartz gravel flats in Succulent Karoo, flowers in mid- and late summer. **Fig. XLV.d, XLV.e**

≡ *Cotyledon occultans* Tölken (1977).

Dwarf succulent geophytes with a somewhat globose tuberous subterranean base to 1.5 cm Ø, caudex with grey flaking bark; **Br** 1 - 2, underground or rarely ± above-ground, to 1 cm tall and 5 - 8 mm Ø; **L** 1 (-2), orbicular, flat, 1 - 2.5 cm Ø, recurved and appressed to the ground, peltate, variably glandular-hairy; **Inf** erect thyrses to 8 cm with 1 - 3 monochasia; **Bra** linear, 2 mm; **Fl** erect; **Ped** 10 - 12 mm; **Sep** linear, 2 - 3 mm; **Cl** tubular, 12 - 15 × 2.5 mm, pale yellow to yellowish-green, glabrous, lobes 1.5 mm, recurved.

T. paniculatus (Linné *fil.*) Tölken (BT 12(3): 380, 1978). **T**: RSA, Northern Cape (*Thunberg* s.n. [UPS [Herb. Thunberg 11010]]). – **D**: S Namibia, RSA (Northern Cape); winter-rainfall regions, Succulent Karoo, flowers late spring to mid-summer. **Fig. XLV.f**

≡ *Cotyledon paniculata* Linné *fil.* (1782); **incl.** *Cotyledon fascicularis* Aiton (1789); **incl.** *Cotyledon tardiflora* Bonpland (1816); **incl.** *Cotyledon mollis* Dinter (1923) (*nom. inval.*, Art. 32.1, 53.1).

Erect robust pachycaul shrubs to 2.5 m with a rounded crown, usually well-branched with a single

main trunk to ± 40 cm Ø; **R** fibrous; bark smooth, peeling in semitranslucent yellowish-brown horizontal strips exposing the green fleshy stem; **Br** softly fleshy and brittle, young **Br** with greyish-green bark; **L** ascending-spreading, flat to somewhat channelled, glabrous or densely hairy on young plants, 5 - 9 × 2 - 4 cm, elliptic, ovate to oblanceolate, grass-green, rarely glaucous, margin entire, sometimes wavy, base cuneate, apex rounded to obtuse; **L** rudiments at **Br** tips triangular, 3 × 2 mm, soon becoming brown and withering; **Inf** ascending thyrses to 40 cm with 3 - 6 monochasia; peduncle reddish; **Bra** 15 - 20 × 3 - 5 mm; **Fl** spreading to subnate; **Cl** tubular, orange-yellow to red, to 20 × 8 mm Ø, glandular-hairy on the outside or glabrous, lobes spreading, becoming reflexed.

Natural hybrids have been recorded between *T. paniculatus* and *T. wallichii*.

T. pearsonii (Schönland) Tölken (BT 12(3): 380, 1978). **T**: RSA, Northern Cape (*Pearson* 5981 [GRA]). – **D**: S Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, flowers early to mid-summer.

≡ *Cotyledon pearsonii* Schönland (1912); **incl.** *Cotyledon luteosquamata* von Poellnitz (1939).

Dwarf branched succulent shrubs with an attractive pachycaul stem to 3.5 cm Ø; young **Br** grey-green, covered with short grey-white truncate to rounded phyllopodia to 1 mm, older **Br** with yellow-brown peeling bark; **L** crowded at **Br** tips, ascending to spreading, curved inwards, 2.5 - 8 cm × 5 - 7 mm, linear to linear-lanceolate to almost terete, grey-green with shiny papillae, upper face with shallow groove, lower face convex, base cuneate, apex acute with reddish mucro; **Inf** short thyrses, 3.5 - 8 cm, with 1 - 3 monochasia; **Ped** 6 - 7 mm; **Fl** ascending, or spreading to pendulous, **Cl** campanulate to 15 × 7 mm, light brown, bulging in the middle, glandular-hairy.

T. peculiaris van Jaarsveld (Aloe 35(1): 10-11, ill., 1998). **T**: RSA, Western Cape (*van Jaarsveld & Theart* 14796 [NBG]). – **D**: RSA (Western Cape); Succulent Karoo, quartz gravel flats, flowers mid- to late summer.

Dwarf geophytic succulents to 1 cm tall from an oblong to depressed-globose caudex consisting of 2 to 3 fleshy horizontal to vertical **R**, 1.8 - 3.5 cm long and 1.5 - 2.5 cm Ø, with grey peeling bark and purplish-pink flesh; **Br** 1, to 7 mm tall and 3 - 4 mm Ø with grey peeling bark; **L** 1, sessile, appressed to the ground, dark purplish-green, orbicular-ovate, peltate, 12 - 16 × 10 - 15 mm and 8 - 10 mm thick with a deep central groove, sometimes almost hollow, surface minutely rugose, the ridges dark green with purple cells in between bearing sessile globose shiny white translucent **Gl**; **Inf** thyrses to 4.5 cm, consisting of a single monochasium bearing 1 - 3

arcuate-ascending **Fl**; peduncle 2 cm, purplish-black, minutely grooved; **Ped** 18 - 25 mm; **Bra** linear, acute, 1 - 2 mm, appressed, soon withering; **Sep** triangular-lanceolate, 2 × 0.75 mm, covered with dense club-shaped glandular **Ha**, reddish-brown; **Cl** tube 6 × 3 mm, pale cream to yellowish-cream, with club-shaped glandular **Ha**, lobes 3 × 2 mm, greenish; **Fr** 6 - 7 mm long.

T. pusillus Bruyns (SAJB 55(3): 335-336, ill., 1989). **T**: RSA, Northern Cape (*Bruyns* 2888 [BOL]). – **D**: RSA (Northern Cape: Richtersveld); Succulent Karoo, pockets in quartzitic sandstones, flowers mid-summer to autumn.

Dwarf branched succulents to 4.5 cm tall with a subterranean or partly exposed tuberous base 2.5 cm Ø with grey peeling bark; **Br** short, to 2 cm Ø at the base, **L**-bearing **Br** 3 mm Ø; **L** 1 - 5, crowded at stem tips, spreading and appressed to the ground, reniform-orbicular to cordate, 4 - 12 × 5 - 17 mm, glandular-hairy with translucent trichomes, base cuneate, apex obtuse to acute, upper face flat to channelled, lower face convex; **Inf** erect thyrses to 7 cm with 1 - 3 monochasia; **Fl** erect; **Ped** 5 - 6 mm; **Cl** cylindrical, pale yellow, 5 - 6 mm, glandular-pubescent, lobes yellow, hairy on the upper face, becoming recurved.

T. pygmaeus (W. F. Barker) Tölken (BT 12(3): 380, 1978). **T**: RSA, Western Cape (*Vigne* s.n. [BOL, K]). – **D**: RSA (Western Cape); Succulent Karoo, quartz gravel flats, summer-flowering. **Fig. XLVI.d**

≡ *Cotyledon pygmaea* W. F. Barker (1930); **incl.** *Cotyledon pygmaea* var. *pygmaea*; **incl.** *Tylecodon pygmaeus* var. *pygmaeus*.

Small sparingly branched succulents 10 - 20 cm tall with a subterranean tuberous base to 7 cm Ø with pink-brown flesh; **Br** smooth, grey, 8 mm Ø at the base tapering to 3 mm; **L** obovate, linear-oblancheolate to almost terete and club-shaped, 2 - 50 × 5 - 45 mm, covered with shiny translucent heart-shaped to globose crystal-like **Ha**, base cuneate, apex obtuse; **Inf** thyrses to 4.5 cm with 1 - 3 monochasia each bearing 1 - 3 erect **Fl**; **Ped** 5 - 15 mm; **Cl** pale yellowish-green, cylindrical, to 6 mm, lobes as long as the tube, spreading becoming recurved.

T. racemosus (Harvey) Tölken (BT 12(3): 380, 1978). **T**: RSA, Northern Cape (*Drège* s.n. [S, BM, K, LE]). – **D**: S Namibia, RSA (Northern Cape); Succulent Karoo, flowers in early summer. **Fig. XLVI.b**

≡ *Cotyledon racemosa* Harvey (1862); **incl.** *Cotyledon chloroleuca* Dinter ex H.-C. Friedrich (1960).

Variable erect sparingly branched shrublets 20 - 50 cm tall with a single main stem to 7 × 4.5 cm Ø; **Br** green with yellow-brown to grey horizontally

peeling bark, younger **Br** 8 mm Ø; **L** softly succulent, ascending to spreading, crowded at stem tips, green, glandular-hairy, glabrous or with shiny translucent papillae, occasionally with reddish striations at the base, linear-lanceolate, linear-oblancheolate to spatulate, 2.5 - 10 × 0.8 - 3.7 cm, upper face flat to grooved to broadly channelled at the base; **L** withering towards summer but persistent, finally leaving distinct white horizontal scars; **Inf** erect thyrses, 8 - 10 cm, with 3 - 6 spreading monochasia; peduncle glandular-hairy to glabrous, 3 - 4 mm Ø at the base, tapering upwards; **Bra** linear-lanceolate, becoming smaller upwards, soon deciduous; **Fl** spreading to ascending; **Ped** 8 - 17 mm; **Sep** linear-lanceolate, 9 - 10 × 1 - 2.5 mm; **Cl** tubular widening towards the mouth, 10 - 15 × 4 mm Ø, pink or white with darker pink to purplish striations, slightly glandular-pubescent, lobes spreading, often becoming recurved.

T. reticulatus (Linné *fil.*) Tölken (BT 12(3): 380, 1978). **T**: RSA, Cape Prov. (*Thunberg* s.n. [UPS [Herb. Thunberg 11013]]). – **D**: Namibia, RSA.

≡ *Cotyledon reticulata* Linné *fil.* (1782).

T. reticulatus ssp. *phyllopodium* Tölken (BT 12(3): 380, 1978). **T**: Namibia (*Dinter* 8092 [BOL, WIND]). – **D**: S Namibia, RSA (Northern Cape); Succulent Karoo. **Fig. XLVI.a**

Differs from ssp. *reticulatus*: **L**-bearing **Br** thinner, 4 - 8 mm Ø, with distinct brown or grey to black truncate phyllopodia to 2 mm tall; **L** 2 - 6 cm × 4 - 6 mm, terete, erect, green to bluish- or yellowish-green, sometimes slightly grooved on the upper face, apex obtuse or acute, with reddish mucro; **Bra**-like **L** subulate, 1.5 mm, giving rise to pointed phyllopodia; **Inf** lax thyrses, 2.5 - 27 cm, not as dense and compact as in ssp. *reticulatus*; **Ped** 1.2 - 2.5 cm.

This subspecies is fairly variable, and the following local forms are recognized as cultivars:

'Khamiesberg': Subterranean caudex to 5 cm Ø, with up to 35 erect blackish **Br** bearing short phyllopodia; **Inf** lax with 1 - 2 monochasia to 2 cm.

'Strandfontein': Plants short, compact, 2 - 4 cm tall with **Br** to 3 cm Ø at the base; **L** to ± 5 mm; **Inf** forming a dense reticulate crown.

T. reticulatus ssp. *reticulatus* – **D**: S Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, quartz gravel flats, flowers in late spring and summer. **Fig. XLVI.c**

Incl. *Cotyledon dichotoma* Haworth (1819); **incl.** *Cotyledon parvula* Burchell (1822).

Plants variable with thick squat, basally normally solitary stem, 3 - 38 cm tall with a rounded sparingly branched crown to 30 cm Ø; main stem to 6 cm Ø with brown bark peeling in strips; younger **Br** ascending, grey-green, 8 mm Ø; **L** crowded at **Br** tips, variable, 5 - 40 × 3 - 10 mm, flat, glabrous to glandular-hairy, ovate, linear-lanceolate to linear-

oblanceolate, erect to ascending, glaucous, base cuneate, apex obtuse with a reddish mucro; **Inf** thyrses to 7 cm tall and Ø, with many dichasia each bearing 2 - 6 spreading to erect **Fl**, persisting after flowering and forming a dense reticulate crown above **L** and **Br**; **Ped** 6 - 8 mm; **Sep** 2 - 4 mm, glandular-pubescent, lanceolate to triangular, loose and star-shaped when dry after anthesis but remaining attached to the **Ped**; **Cl** yellowish-green, tinged brown, tubular (sometimes urceolate), 6 - 8 × 2.5 mm Ø, laxly hairy on the outer and inner surface and lobes; lobes 2 - 3 mm, spreading and becoming recurved.

T. rubrovenosus (Dinter) Tölken (BT 12(3): 380, 1978). **T**: Namibia (*Dinter* s.n. [B]). – **D**: S Namibia, RSA (Northern Cape); Succulent and Nama Karoo, flowers in spring and early summer. **Fig. XLVII.d**

≡ *Cotyledon rubrovenosa* Dinter (1932).

Sparingly branched ascending succulents to 30 cm tall, with solitary main stem; **Br** grey-green, 2 cm Ø (to 4 cm Ø at the base), occasionally becoming thicker upwards, with short irregularly shaped phyllopodia to 1 mm tall; bark peeling at the base, grey-brown; **L** crowded at **Br** tips, linear-lanceolate, ascending, curved inwards, with conspicuous reddish striations, ± terete, glandular-hairy to glabrous, upper face slightly grooved, lower face convex; **Inf** spreading thyrses to 20 (-37) cm with 3 - 5 spreading monochasia; **Fl** pendulous, **Sep** 6 - 7 mm; **Cl** tubular, 7 - 15 mm, yellowish-green, glandular-pubescent, lobes spreading to recurved.

T. scandens van Jaarsveld (CSJA 67(1): 40-43, ill., 1995). **T**: RSA, Western Cape (*van Jaarsveld & Saunders* 12842 [NBSG]). – **D**: RSA (Western Cape); Succulent Karoo, flowers in late summer. **Fig. XLVI.e**

Dwarf scandent succulents with a single spreading stem to 16 cm from a tuberous-rooted base; tuber soft, with greyish peeling bark, flesh reddish-pink; **Br** 1.5 mm Ø, zigzag, green becoming black, with long recurved truncate phyllopodia 5 - 10 mm, grooved on the upper face and of the same thickness and texture as the stem, this covered with depressed persistent grey **Ha**, becoming ultimately glabrous when old; **L** 6 - 8 × 4 - 6 mm Ø, dorsiventrally compressed and grooved on the upper face, narrowly elliptic to obovate, densely covered with club-shaped **Ha**; **Inf** spreading thyrses to 8 cm consisting of a single monochasium bearing 1 - 3 arcuate-ascending **Fl**; **Ped** to 3 cm; **Cl** 10 mm, green, ovoid, 4 mm Ø at the base, narrowing to 3 mm and expanding again to 4 mm at the throat, with club-shaped glandular **Ha**, lobes greenish with reddish striations; **NSc** yellow, oblong, erect, emarginate, 1.5 × 0.5 mm.

T. schaeferianus (Dinter) Tölken (BT 12(3): 380,

1978). **T**: Namibia (*Dinter* 4449 [B †]). – **D**: SW Namibia, RSA (Northern Cape: Richtersveld); flowers in late summer. **Fig. XLVI.f**

≡ *Cotyledon schaeferiana* Dinter (1923) ≡ *Adromischus schaeferianus* (Dinter) A. Berger (1930); **incl.** *Cotyledon hoerleiniana* Dinter (1923) ≡ *Adromischus hoerleinianus* (Dinter) von Poellnitz (1940); **incl.** *Cotyledon hoerleiniana* var. *schaeferi* Dinter (1923) (*nom. inval.*, Art. 32.1c); **incl.** *Cotyledon schaeferi* Dinter (1931) (*nom. inval.*, Art. 32.1c); **incl.** *Adromischus keilhackii* Werdermann (1932) ≡ *Adromischus schaeferianus* var. *keilhackii* (Werdermann) von Poellnitz (1940); **incl.** *Cotyledon sinus-alexandri* von Poellnitz (1938); **incl.** *Tylecodon aridimontanus* G. Williamson (1995).

Dwarf highly branched variable spreading succulents often forming tufted mounds with interwoven stems and tubers to 10 cm Ø and 7 cm tall; **R** tuberous to 1 cm Ø, grey, with flaking bark; **Br** spreading to ascending, 2 - 5 mm Ø, sometimes with aerial **R**; bark knobbly from the irregular phyllopodia, irregularly grey-brown; **L** obovate, elliptic to orbicular, 5 - 15 × 6 - 12 mm, thick and slightly dorsiventrally compressed, apex obtuse with reddish mucro; **Inf** thyrses to 2.5 cm with 1 - 2 monochasia, each bearing 1 - 2 erect **Fl**; **Ped** 1 cm; **Cl** tubular, 7 - 10 × 4 mm, glabrous, pink or white, lobes spreading to recurved, 4 mm.

T. similis (Tölken) Tölken (BT 12(3): 380, 1978). **T**: RSA, Northern Cape (*Wisura* 1303 [NBSG]). – **Lit**: Williamson (1997: with ill.). **D**: RSA (Northern Cape); Succulent Karoo, flowers in spring and early summer. **Fig. XLVII.a**

≡ *Cotyledon similis* Tölken (1977).

Very variable dwarf sparingly branched erect to trailing succulents to ± 10 cm tall with an underground tuber to 3 cm Ø with grey-brown peeling bark; **Br** 1, rarely with few side **Br**, to 12 cm, 1.5 - 3 mm Ø, fairly straight to zigzag (forms from Karra-chab); bark grey with black striations or spots; **L** very variable, crowded at **Br** tips, flat to almost terete, round, broadly obovate to cordate, glabrous or papillate, green, 3 - 15 × 3 - 7 mm, upper face grooved to concave, lower face convex, often maroon-green; **Inf** monochasia to 3 cm with 1 - 3 erect **Fl**; **Bra** linear; **Ped** ± 1 cm; **Cl** tubular to almost urceolate, 6 - 8 × 2 - 3 mm, pale yellow or cream, lobes 1.5 - 2 mm, recurved, usually densely hairy to almost glabrous on the inner surface.

T. singularis (R. A. Dyer) Tölken (BT 12(3): 380, 1978). **T**: Namibia (*Hardy* 2632 [PRE]). – **D**: S Namibia; Succulent Karoo, rare endemic on limestone, flowers in spring and early summer.

≡ *Cotyledon singularis* R. A. Dyer (1970).

Dwarf succulent geophytes with a subterranean tuberous base; **R** succulent, fusiform; **Br** to 10 × 7 mm, glabrous, without phyllopodia; **L** usually 1 (-4 in cultivation), orbicular, 5 - 8 cm Ø, concave, cor-

date at the base and shortly petiolate, glandular-hairy, lower face purplish, petiole channelled; **Inf** erect spreading thyrses, 15 - 35 cm, consisting of 2 - 4 monochasia each with 5 - 10 erect to spreading **Fl**; **Cl** tubular, to 13 mm, slightly widening towards the throat, pale yellowish-green with short **Ha** on the inside, lobes 6 - 7 mm, recurved; **NSc** square, $\pm$ 1 mm, entire or emarginate, yellowish.

T. stenocaulis Bruyns (SAJB 58(1): 52-54, ill., 1992). **T**: RSA, Western Cape (*Bruyns* 4023 [BOL]). – **D**: RSA (Western Cape); Succulent Karoo, flowers in late summer.

Dwarf spreading succulents to 8 cm tall and 12 cm $\varnothing$ with shallow-rooted stems and indistinct tuber $\pm$ 2 cm $\varnothing$; **Br** spreading to erect, to 12 cm, 3 mm $\varnothing$, covered with short tapering phyllopodia to 2 mm; bark grey-brown; **L** variable, 7 - 35 $\times$ 5 - 7 mm, slightly flattened to almost terete, mostly oblanceolate, maroon-green, with short shiny glandular **Ha**, base cuneate, apex acute to obtuse; old **L** withering, bases often persistent; **Inf** spreading thyrses to 6 cm of 1 - 3 monochasia; **Fl** spreading to ascending; **Ped** slender, 1 - 3.5 cm; **Cl** funnel-shaped, 12 - 14 mm, yellowish-green, lobes 5 $\times$ 1.5 mm, spreading to recurved, dark maroon, acuminate.

T. striatus (Hutchison) Tölken (BT 12(3): 380, 1978). **T**: RSA, Northern Cape (*Rodin* 1405 [BOL, PRE]). – **D**: RSA (Northern Cape, Western Cape); Succulent Karoo, flowers in mid-summer.

$\equiv$ *Cotyledon striata* Hutchison (1964).

Sparingly branched spreading succulent shrublets to 2.5 cm $\varnothing$ and 18 (-25) cm tall with an underground tuberous base to 6 cm $\varnothing$; **Br** erect or spreading, 5 - 10 mm $\varnothing$, often scandent; young **Br** with pale grey-green bark with darker striations, older **Br** with yellowish peeling bark; phyllopodia 1 - 3 mm tall, rounded, tapering; **L** linear to linear-oblan-ceolate, rarely almost terete, 3.5 - 10 cm $\times$ 3 - 6 mm, upper face grooved or channelled, rarely flat, apex acute to obtuse, mucronate; old **L** withering, persistent; **Inf** elongated glandular-pubescent thyrses to 35 cm with 1 - 5 monochasia; **Fl** erect to spreading; **Ped** 1 - 1.8 cm; **Cl** tubular, 12 - 15 mm, greenish-brown, ventricose in the middle.

T. suffultus Bruyns *ex* Tölken (BT 12(3): 380, 1978). **T**: RSA, Western Cape (*Bruyns* 1091 [PRE]). – **D**: RSA (Western Cape); Succulent Karoo, flowers in mid-summer.

Small trailing sparingly branched succulents with an underground branched tuber; **Br** to 30 cm, 3 - 5 mm $\varnothing$, grey with darker striations; **L** crowded at **Br** tips, linear-elliptic, glabrous, 1 - 3 cm $\times$ 2 - 3 mm, upper face grooved, lower face convex, base cuneate, apex obtuse or acute; **Inf** spreading thyrses to 10 cm with 3 - 5 monochasia, each bearing 1 - 3 erect **Fl**; peduncle glandular-pubescent; **Ped** 1.2 - 2

cm; **Sep** linear-lanceolate, 3 $\times$ 1 mm, glandular-pubescent; **Cl** tubular, 5 - 8 $\times$ 3 mm, lobes to 5 mm, oblong, red-pink on the inside, spreading and becoming recurved.

T. sulphureus (Tölken) Tölken (BT 12(3): 381, 1978). **T**: RSA, Northern Cape (*Tölken* 3676A [BOL]). – **D**: RSA.

$\equiv$ *Cotyledon sulphurea* Tölken (1977).

T. sulphureus var. **armianus** van Jaarsveld (FPA 50(2): t. 1984 + 2 pp. of text, 1989). **T**: RSA, Northern Cape (*van Jaarsveld & Patterson* 6639 [NBG]). – **D**: RSA (Northern Cape); Succulent Karoo, steep shady cliffs (granodiorite), rock crevices, flowers in mid-summer. **Fig. XLVII.b**

Differs from var. *sulphureus*: **Cl** pinkish-white; flowering a month later.

T. sulphureus var. **sulphureus** – **D**: RSA (Northern Cape); Succulent Karoo, quartz gravel flats, flowers in mid-summer.

Dwarf sparingly branched succulents with a tuberous base (occasionally almost geophytic); stems erect, covered with pale phyllopodia; **L** small, 5 - 25 $\times$ 2 - 8 mm, oblanceolate, elliptic-linear, glabrous but covered with minute papillae, grooved on the upper face, apex obtuse; **Inf** erect flat-topped thyrses, 3.5 - 4 cm, of 1 - 3 monochasia; **Cl** tubular, 8 - 12 mm, glandular-pubescent, white, light pink or light yellowish-brown, lobes recurved.

T. tenuis (Tölken) Bruyns (SAJB 58(1): 54-55, ill., 1992). **T**: RSA, Western Cape (*Hall* 3925 [PRE, NBG]). – **D**: RSA (Western Cape); Succulent Karoo, quartz gravel flats, summer-flowering.

$\equiv$ *Cotyledon pygmaea* var. *tenuis* Tölken (1977) $\equiv$ *Tylecodon pygmaeus* var. *tenuis* (Tölken) Tölken (1978).

Dwarf scandent succulents with a single spreading stem from a tuberous rooted base to 2 cm $\varnothing$; tuber soft, flesh whitish, bark not peeling; **Br** to 16 cm, 1.5 - 2 mm $\varnothing$, zigzag, first green and glandular-hairy, later grey with longitudinal white raised ridges and short truncate phyllopodia to 1 mm; **L** 8 - 18 $\times$ 4 - 8 mm $\varnothing$, subterete, narrow-elliptic to narrow-obovate, densely beset with oblong and club-shaped **Ha**, upper face grooved, base cuneate, apex obtuse; **Inf** spreading thyrses to 4 cm of 1 - 3 monochasia each bearing 1 - 3 erect to spreading **Fl**; **Sep** triangular-lanceolate; **Cl** tubular, 8 mm, green, 4 mm $\varnothing$ at the base narrowing slightly towards the throat, with club-shaped glandular **Ha**, lobes greenish with reddish striations on both sides; **NSc** yellow, oblong, erect, emarginate, 1.5 $\times$ 0.5 mm.

T. torulosus Tölken (BT 12(3): 381, 1978). **T**: RSA, Northern Cape (*Tölken* 5317 [PRE]). – **D**: S Namibia, RSA (Northern Cape); Succulent Karoo, flowers in late summer. **Fig. XLVII.c**

Small sparingly branched ascending pachycaul succulent shrublets to 25 cm tall and 25 cm Ø with tuberous base, sometimes with pendulous **Br** to 30 cm from rock faces; **Br** greyish-white, to 3 cm Ø at the base, tapering to 5 mm Ø above with swollen nodes; bark grey, smooth, flaking on older stems; **L** 2.5 - 4 × 1.3 - 2.2 cm, spreading, crowded at **Br** tips, ovate to spatulate, rarely 3-lobed, grey- to yellowish-green, flat, base cuneate, apex obtuse or acute, often becoming recurved; **Inf** short rounded almost sessile thyrses of 2 - 5 monochasia each with 1 - 3 erect **Fl**; peduncle 2 - 3 mm; **Ped** 3 - 5 mm; **Cl** tubular, 18 - 23 × 5 mm, yellowish-green, glandular-pubescent on the outside, lobes to 5 mm, spreading becoming recurved.

T. tribblei van Jaarsveld (Bradleya 15: 68-72, ill., 1997). **T**: RSA, Northern Cape (van Jaarsveld & Muller 14729 [NKG]). – **D**: RSA (Northern Cape: Namaqualand escarpment); Succulent Karoo, flowers in late summer.

Scandent succulents with a single erect to spreading stem to 40 cm tall from a tuberous rooted base; tuber divided, to 3 - 5 cm Ø, flesh white, bark greyish, flaking; **Br** glabrous, to 4 mm Ø (young 2 mm Ø and green), distinctly ribbed, becoming greyish-white, without phyllopodia; **L** ascending, linear, subterete, 1.5 - 2 cm × 1 - 2 mm, green, glabrous but minutely papillate, upper face grooved, lower face convex, apex acute, withered **L** persistent; **Inf** spreading thyrses, 6 - 7 cm; peduncle with glandular **Ha**; **Fl** erect; **Ped** 1.5 cm; **Sep** 4 × 1 mm; **Cl** 9 - 10 × 3 mm Ø, tubular, yellowish-green, with club-shaped glandular **Ha**, lobes pale yellow-green with brown striations on both sides, glandular-hairy, 7 × 2 mm, lorate, apiculate, spreading, margins revolute; **NSc** white, oblong, erect, emarginate, 1.3 × 0.5 mm.

T. tuberosus Tölken (BT 12(3): 381, 1978). **T**: RSA, Northern Cape (Marloth 13229 [PRE]). – **D**: RSA (Northern Cape); Succulent Karoo, flowers in mid-summer.

Dwarf succulent geophytes to 15 cm Ø with branching tuberous base; **R** tuberous, tapering, to 5 mm Ø; **Br** to 2 cm, 5 mm Ø, decumbent or erect, usually subterranean but exposed for up to 1 cm, then grey-green covered with short pointed phyllopodia <1 mm in length; **L** in a basal **Ros**, spreading, flat, densely hairy, 1.3 - 3 × 0.5 - 1.2 cm, elliptic to obovate, base cuneate, apex obtuse; **Inf** erect thyrses, 12 - 30 cm of 2 - 8 monochasia; peduncle glandular-hairy, 2 mm Ø at the base; **Fl** erectly spreading; **Ped** 7 mm; **Cl** tubular, pale greenish-brown, 15 - 20 mm, slightly bulging near the middle, lobes spreading becoming recurved.

T. ventricosus (Burman fil.) Tölken (BT 12(3): 382, 1978). **T**: [icono]; Burman, Rar. Afr. Pl. t. 21,

fig. 1, 1732. – **D**: RSA (Northern Cape, Western Cape, Eastern Cape); Succulent Karoo and Renosterveld, flowers in mid-summer. **Fig. XLVIIe**

≡ *Cotyledon ventricosa* Burman fil. (1768); **incl.** *Cotyledon ventricosa* var. *alpina* Harvey (1862); **incl.** *Tylecodon jarmilae* Halda (1998).

Variable sparingly branched geophytes or with above-ground spreading stems to 16 cm tall forming small clusters to ± 30 cm Ø; **R** tuberous, tuber oblong-globose, 1.6 - 2 × 2.8 cm, bark grey-green, peeling in yellowish flakes at the base; phyllopodia short to oblong and tapering, to 8 mm, becoming grey-green; **L** in a basal **Ros** or crowded at **Br** tips, 4.5 - 9 × 0.5 - 2 cm, ascending to spreading, flat, subpetiolate, obovate, subspatulate to linear-oblan-ceolate, glabrous or sparingly glandular-pubescent, upper face flat to grooved, lower face convex, base cuneate, apex obtuse or acute, mucronate; **Inf** 20 - 50 cm; peduncle glandular-hairy, to 5 mm Ø at the base tapering to 1 mm above; lower **Bra** **L**-like, linear-lanceolate, 2 - 3 mm apart, upper **Bra** linear with incurved tips, 10 - 12 × 2 mm, 1.5 - 3 cm apart, all **Bra** deciduous during anthesis; **Fl** erect to spreading; **Ped** 12 - 15 mm; **Cl** tubular, 22 - 25 mm, ventricose in the middle, 4 mm Ø at the base bulging to 7 mm Ø, greenish-yellow with purple striations, lobes triangular-acuminate, 7 × 2.5 mm, spreading becoming recurved.

A very variable taxon with several forms, but the flowers remain remarkably constant. Geophytic forms with spatulate leaves and short phyllopodia are widely spread on the Roggeveld Plateau, in the Ceres Karoo and in the W part of the Little Karoo. Along the W coast, plants with ascending branches and long phyllopodia are found.

T. viridiflorus (Tölken) Tölken (BT 12(3): 382, 1978). **T**: RSA, Northern Cape (Tölken 5327 [PRE]). – **D**: RSA (Northern Cape); Succulent Karoo, rock-crevices, flowers in mid-summer. **Fig. XLVII.f**

≡ *Cotyledon viridiflora* Tölken (1977).

Erect sparingly branched succulent shrubs to 35 cm tall and 20 cm Ø, base slightly tuberous, to 1.5 cm Ø with 1 to few main **Br** to 1 cm Ø with grey bark peeling vertically; young **Br** first brown, becoming paler with age; **L** crowded, ascending to spreading, elliptic, oblanceolate to broadly ovate, flat, 2 - 5.5 × 0.8 - 3 cm, occasionally 3-lobed, glandular-hairy, upper face often channelled, base cuneate, apex obtuse to acute; **Inf** thyrses to 4.5 cm of 1 - 3 monochasia each with 1 - 2 erect **Fl**; **Cl** tubular, 14 - 20 × 5 mm Ø, greenish, lobes to 7 mm, spreading becoming recurved; **Se** winged (a unique character for the family in South Africa and probably as a whole).

This species together with *T. torulosus* and *T. longipes* forms a group of closely related species; they are the only tylecodons that occasionally form 3-lobed leaves.

T. wallichii (Harvey) Tölken (BT 12(3): 382, 1978). **T:** RSA, Cape Prov. (*Wallich* s.n. [K]). – **D:** Namibia, RSA.

≡ *Cotyledon wallichii* Harvey (1862) ≡ *Tylecodon papillaris* ssp. *wallichii* (Harvey) G. D. Rowley (1990).

T. wallichii ssp. *ecklonianus* (Harvey) Tölken (BT 12(3): 382, 1978). **T:** RSA, Northern Cape (*Ecklon & Zeyher* 1967 [S, SAM]). – **D:** S Namibia, RSA (Northern Cape); Succulent Karoo, flowers in mid-summer.

≡ *Cotyledon eckloniana* Harvey (1862) ≡ *Tylecodon papillaris* ssp. *ecklonianus* (Harvey) G. D. Rowley (1990); **incl.** *Cotyledon dinteri* Baker fil. (1903).

Differs from ssp. *wallichii*: Peduncle and **Ped** glabrous; **Cl** lobes with few glandular-hairy cilia.

T. wallichii ssp. *wallichii* – **D:** S Namibia, RSA (Northern Cape, Western Cape); Succulent Karoo, flowers in mid-summer.

Low sparingly branched shrubs to 50 cm tall, with a single greyish-black main stem to 6 cm Ø; younger **Br** grey-green, to 1.5 cm Ø, densely covered with long phyllopodia to 15 × 2–3 mm with obliquely acute tips; **L** crowded at **Br** tips, 6.5–9.5 cm × 5–6 mm, grey-green, ascending and curved inwards, glabrous, linear but tapering towards the apex, terete or shallowly grooved on the upper face, base cuneate, apex acute, yellowish with reddish murex; **Inf** ascending mostly glandular-hairy thyrses to 45 cm with up to 8 erectly spreading monochasia; peduncle to 34 cm, 5 mm Ø at the base; **Fl** spreading to pendent; **Ped** 4–5 mm; **Sep** triangular, 3 × 2 mm; **Cl** tubular, yellowish, 7–12 mm, lobes spreading to recurved.

UMBILICUS

C. C. Walker

Umbilicus De Candolle (Bull. Sci. Soc. Philom. Paris 3(49): 1, 1801). **T:** *Cotyledon umbilicus-veneris* Linné [Typification according to ING.]. – **D:** W and C Europe, Macaronesia, Mediterranean, Near East, W Asia to W Caucasus, Arabia, N, C and E Africa. **Etym:** Lat., navel; for the central navel-like depression of the peltate leaves.

Incl. *Chiastophyllum* Link (nom. illeg., Art. 52.1). **T:** *Cotyledon umbilicus-veneris* Linné.

Incl. *Chiastophyllum* (Ledebour) Stapf ex A. Berger (1930). **T:** *Cotyledon oppositifolia* Ledebour.

Small glabrous perennial ± deciduous succulent herbs, nearly always with tuberous or rhizomatous **Rstock** (except *U. oppositifolius*); **L** petiolate, lamina suborbicular, usually (except *U. oppositifolius*) ± peltate with a central dimple, softly fleshy, margin crenate-dentate; cauline **L** usually progressively smaller, linear-lanceolate; **Inf** mostly many-

flowered long terminal racemes or panicles, sometimes branched; **Fl** sometimes erect, more usually horizontal or drooping, 5-merous, usually obdiplostemonous; **Cal** small; **Cl** tubular or campanulate, lobes erect or apically spreading but always fused at the base, white, green or yellow, sometimes flushed with purple; **St** 10 (occasionally 5); **Fil** usually fused with the **Cl** lobes for most of their length; **Sty** short or absent; **Fr** slender follicles.

A genus of ± 12 species. At the time of writing there is no modern monograph available, and typification has not been fully resolved (*Cotyledon umbilicus-veneris* Linné includes 2 elements, *U. umbilicus-veneris* and *U. rupestris*). There are many defunct synonyms under *Umbilicus* which are not treated here, and only the main elements are discussed. A revision of the genus is needed, which will undoubtedly result in a reduction in the number of accepted taxa.

Plants tend to be very plastic in response to environmental conditions (most notably availability of water and light). The flowers of most (all?) tubular-flowered species of Sect. *Umbilicus* are probably self-pollinating, and this inbreeding tendency is probably responsible for the variation patterns observed in wild populations.

Species of *Umbilicus* are rarely cultivated, apart from *U. rupestris* and *U. oppositifolius*, the latter being very hardy in temperate latitudes and frequently grown as a rock garden plant.

The genus falls into 2 clearly defined groups:

- [1] Sect. *Umbilicus*: **Rstock** tuberous or rhizomatous; basal **L** always peltate (all species except *U. oppositifolius*).
- [2] Sect. *Chiastophyllum* Ledebour 1845: **R** fibrous; **L** opposite, not peltate (only *U. oppositifolius*).

The following names are of unresolved application but are referred to this genus: *Cotyledon umbilicus-veneris* var. *eu-pendulina* Maire (1932); *Umbilicus horizontalis* var. *majoricensis* Barceló (1880) ≡ *Umbilicus vulgaris* fa. *majoricensis* (Barceló) Knoche (1922).

U. albido-opacus A. Carlström (Willdenowia 14(1): 22, ill., 1984). **T:** Greece, Rhodos (*Carlström* 676 [LD]). – **D:** Greece (Rhodos: Khalki); moist sites on limestone cliffs, 100–650 m.

[1] Basal **L** orbicular, peltate, to 2.5 cm Ø, petiole 7–11 cm, margin sinuate-crenate; cauline **L** peltate or obovate, dentate-crenate; **Inf** branched racemes to 25 cm; **Fl** erect or pendulous; **Ped** 3–4 mm; **Cl** yellowish-white, sometimes tinged red, to 5–6.5 mm, 3–4 mm Ø, obovoid-obconical, lobes to 3–4 × 1.5–1.8 mm; **Anth** 0.7 mm Ø; **Sty** to 0.5 mm; **Sti** capitate; **Fr** 5 × 1 mm; **Se** numerous, ellipsoid, 0.3 × 0.2 mm.

A taxon of uncertain status. It is closest to *U. parviflorus* and *U. chloranthus*; the latter occurs at the

same localities as *U. albido-opacus*, which is distinguished by the laxer, more diffuse inflorescences, and by the yellowish-white colour of the corolla.

U. botryoides Hochstetter ex A. Richard (Tent. Fl. Abyss. 1: 308, 1848). – **D:** W African Mountains (Cameroon), Sudan, Ethiopia, Somalia, S to Tanzania. **I:** Agnew & Agnew (1994: t. 9).

[1] **L** 3 - 4 cm Ø, orbicular, peltate, margin slightly crenate; **Inf** erect, to ± 30 cm tall; **Ped** to 3 mm; **Fl** drooping; **Sep** oblong, ovate-triangular, to 2 mm; **Cl** urceolate, to 8 × 5 mm, lobes fused below for most of their length, free tips only ± 2 mm.

Similar to *U. rupestris*, but differing in its shorter pedicels, short and broad sepals and more globular, urceolate corolla.

U. chloranthus Heldreich & Sartori ex Boissier (Fl. Orient. 2: 768, 1872). – **D:** Balkans, SE Italy, Greece, Crete, Turkey. **I:** Eggli (1994: 236). **Fig. XLVIII.c**

≡ *Cotyledon chlorantha* (Heldreich & Sartori ex Boissier) Halácsy (1900).

[1] Basal **L** orbicular, peltate, to 4 cm Ø, margin crenate; cauline **L** deltoid-ovate, sessile; **Inf** often branched with erect **Br**, erect, to 30 cm; **Fl** spreading horizontally or drooping; **Ped** 1.5 - 3 mm; **Cl** campanulate, 3 - 4 mm long and Ø, (greenish-) yellow, lobes free almost to the base, ± spreading.

Closely allied to *U. parviflorus*, but with more distinctly peltate leaves. Its occurrence in Italy was only recently reported (Jalas & al. 1999: 47).

U. citrinus Wolley-Dod (J. Bot. 52: 12, 1914). – **D:** S Spain, Gibraltar.

[1] Basal **L** peltate, petiole long, cauline **L** and margins undescribed; **Inf** simple secund racemes to 50 cm, floriferous part to 20 cm; **Fl** horizontal or pendulous; **Ped** 2.5 - 3 mm; **Sep** triangular, acute, to 2 mm; **Cl** tubular, constricted below the lobes, yellow, 9 - 12 mm, lobes ovate-lanceolate, prominently veined.

A taxon of very uncertain status. It differs from both *U. horizontalis* and *U. rupestris* in being taller, in its secund racemes of longer bright yellow flowers, the corolla tube constricted below the longer broad lobes, and in its much shorter carpels. Possibly it represents merely a form of *U. heylandianus*.

U. erectus De Candolle (in Lamarck & De Candolle, Fl. Franç., ed. 3, 4: 384, 1805). **T:** Portugal ? (*Anonymus* s.n. [LINN 594/2]). – **D:** Portugal, S Italy, Balkans, Turkey, Syria, Lebanon, Israel, Saudi Arabia, NW Africa. **I:** Collenette (1985: 191).

Incl. *Cotyledon umbilicus-veneris* var. *umbilicus-veneris*; **incl.** *Cotyledon umbilicus-veneris* Linné (1753) ≡ *Orostachys umbilicus* (Linné) Hort. Monac. ex Schrank & Martius (1829); **incl.** *Cotyledon lutea* Hudson (1762) ≡ *Umbilicus luteus* (Hud-

son) Webb & Berthelot (1840); **incl.** *Cotyledon lusitanica* Lamarck (1786); **incl.** *Cotyledon repens* (Linné) Grande (1911); **incl.** *Umbilicus lassithiensis* Gandoger (1916) ≡ *Umbilicus erectus* var. *lassithiensis* (Gandoger) Stojanoff (s.a.) (*nom. inval.*, Art. ?) ≡ *Cotyledon lassithiensis* (Gandoger) Hayek (1925).

[1] Usually stout plants; basal **L** orbicular, peltate, 3 - 7 cm Ø, margin crenate; cauline **L** ovate-deltoid to linear; **Inf** simple or sometimes branched racemes 30 - 80 cm; **Fl** usually erect; **Ped** 1 - 2 mm; **Cl** tubular, 9 - 14 mm, greenish-yellow, lobes narrowly lanceolate, acute, ± as long as the tube.

For priority reasons, the valid name for this taxon may be *U. luteus*.

U. heylandianus Webb & Berthelot (Phytogr. Canar. 1: 176, 1840). – **D:** Spain, Portugal, Canary Islands (Gran Canaria, La Palma); very localized. **I:** Kunkel & Kunkel (1978: t. 130).

Incl. *Umbilicus pendulinus* var. *praealtus* Brotero (1804); **incl.** *Umbilicus coutinhoi* Mariz (1905) ≡ *Cotyledon coutinhoi* (Mariz) Coutinho (1939) ≡ *Cotyledon praealta* var. *coutinhoi* (Mariz) Sampaio (1947) ≡ *Umbilicus heylandianus* var. *coutinhoi* (Mariz) A. Fernandes (1979); **incl.** *Cotyledon strangulata* Font Quer (1928) ≡ *Umbilicus strangulatus* (Font Quer) A. Berger (1930); **incl.** *Cotyledon umbilicus-veneris* var. *praealta* (Brotero) Pérez-Lara (1971) ≡ *Umbilicus praealtus* (Brotero) Mariz (1905) ≡ *Cotyledon praealta* (Brotero) Sampaio (1911).

[1] Basal **L** peltate, to 7 cm Ø; cauline **L** ± lanceolate, becoming linear in the **Inf**; **Inf** dense simple racemes to 1 m but mostly less, somewhat secund, floriferous part to 35 cm; **Ped** to 3 mm; **Fl** horizontal or drooping; **Cl** tubular, costate, bright yellow, 10 - 12 mm; **St** usually 5.

This is the most distinctive European taxon, distinguished by its relatively tall stature, the bright yellow costate corolla tube strongly constricted at the mouth, and by the reduction in number of stamens.

U. horizontalis (Gussone) De Candolle (PSRV 3: 400, 1828). – **D:** Europe, Canary Islands, E Mediterranean, Iran, Arabia, N Africa, Somalia.

≡ *Cotyledon horizontalis* Gussone (1826) ≡ *Cotyledon umbilicus-veneris* ssp. *horizontalis* (Gussone) Battandier (1889) ≡ *Umbilicus rupestris* ssp. *horizontalis* (Gussone) O. Bolòs & Vigo (1974); **incl.** *Cotyledon umbilicus-veneris* var. *amphitropa* Battandier (1881) ≡ *Cotyledon umbilicus-veneris* fa. *amphitropa* (Battandier) Maire (1977); **incl.** *Umbilicus gaditanus* var. *giganteus* Battandier (1885); **incl.** *Cotyledon umbilicus-veneris* fa. *gigantea* Battandier (1889) ≡ *Cotyledon umbilicus-veneris* var. *gigantea* (Battandier) Maire (1977); **incl.** *Cotyledon horizontalis* var. *micrantha* Pampanini (1917) ≡ *Cotyledon umbilicus-veneris* var. *micrantha* (Pam-

panini) Maire (1977); **incl.** *Cotyledon umbilicus-veneris* var. *font-queri* Maire & Sennen (1933) $\equiv$ *Cotyledon font-queri* (Maire & Sennen) Sennen & Mauricio (1933); **incl.** *Cotyledon umbilicus-veneris* fa. *suberecta* Maire (1934); **incl.** *Cotyledon umbilicus-veneris* var. *pomelii* Maire (1936); **incl.** *Cotyledon umbilicus-veneris* fa. *purpurea* Maire (1938) $\equiv$ *Cotyledon umbilicus-veneris* var. *purpurea* (Maire) Maire (1977); **incl.** *Cotyledon umbilicus-veneris* fa. *parviflora* Maire (1977); **incl.** *Cotyledon umbilicus-veneris* fa. *eu-patens* Maire (1977) (*nom. inval.*, Art. 26.1).

U. horizontalis var. **horizontalis** – **D:** S Europe, Canary Islands, Morocco, Egypt, E Mediterranean, W Iran, Somalia. **I:** Kunkel & Kunkel (1978: t. 131). **Fig. XLVIII.d**

Incl. *Umbilicus horizontalis* ssp. *horizontalis*; **incl.** *Umbilicus gaditanus* Boissier (1846) $\equiv$ *Cotyledon umbilicus-veneris* var. *gaditana* (Boissier) Battandier (1889) $\equiv$ *Umbilicus vulgaris* ssp. *gaditanus* (Boissier) Battandier & Trabut (1904) $\equiv$ *Cotyledon gaditana* (Boissier) Pau (1911) $\equiv$ *Cotyledon umbilicus-veneris* ssp. *gaditana* (Boissier & Reutiner) Emberger & Maire (1941) $\equiv$ *Umbilicus horizontalis* ssp. *gaditanus* (Boissier) Losa & Rivas Godoy (1974); **incl.** *Umbilicus deflexus* Pomel (1876) $\equiv$ *Cotyledon umbilicus-veneris* fa. *deflexa* (Pomel) Battandier (1889) $\equiv$ *Cotyledon umbilicus-veneris* var. *deflexa* (Pomel) Maire (1932); **incl.** *Umbilicus patulus* Pomel (1876) $\equiv$ *Cotyledon umbilicus-veneris* var. *patula* (Pomel) Maire (1977); **incl.** *Umbilicus rodriguezii* Gandoger (1900); **incl.** *Umbilicus giganteus* Battandier & Trabut (1904); **incl.** *Umbilicus maroccanus* Gandoger (1907); **incl.** *Cotyledon umbilicus-veneris* fa. *eu-horizontalis* Maire (1977) (*nom. inval.*, Art. 26.1).

[1] Basal **L** orbicular, peltate, 2 - 5 (-10) cm $\varnothing$, margin crenate; cauline **L** linear, dentate; **Inf** simple or branched racemes to 50 cm; **Fl** spreading horizontally; **Ped** 0.5 - 2 (-2.5) mm; **Cl** greenish-white, occasionally tipped or flushed red, 5 - 7 mm, tubular or urceolate, tube to 4 $\times$ the length of free lobes; lobes broadly lanceolate to ovate-acute. – *Cytology*: 2n = 48.

The horizontally spreading flowers of the typical variety usually distinguish it from *U. rupestris*, although the 2 species are easily confused. *U. horizontalis* typically has smaller corollas and shorter pedicels.

U. horizontalis var. **intermedius** (Boissier) Chamberlain (in P. H. Davis (ed.), *Fl. Turkey* 4: 213, 1972). – **D:** Saudi Arabia, W Syria, Iran, Turkey, Cyprus?, Greece. **I:** Collenette (1985: 191).

$\equiv$ *Umbilicus intermedius* Boissier (1872) $\equiv$ *Umbilicus pendulinus* var. *intermedius* (Boissier) Post (1896) $\equiv$ *Cotyledon intermedia* (Boissier) Bornmüller (1904) $\equiv$ *Cotyledon umbilicus-veneris* ssp. *intermedia* (Boissier) Maire & Weiller (1939) $\equiv$ *Cotyle-*

don umbilicus-veneris var. *intermedia* (Boissier) Maire (1977); **incl.** *Cotyledon umbilicus-veneris* var. *subhorizontalis* Maire & Weiller (1939).

[1] Differs from var. *horizontalis*: **Fl** drooping; **Cl** usually urceolate, lobes ovate.

There is considerable overlap in characters between the 2 varieties, esp. in the E part of the range.

U. oppositifolius (Ledebour) Ledebour (*Fl. Ross.* 2: 176, 1843). **T:** "Caucasus" (*Nordmann* 329 [LE]). – **D:** Georgia (W Caucasus: Abchasia). **I:** Stephenson (1994: fig. 4.6); Eggli (1994: 204). **Fig. XLVIII.a**

$\equiv$ *Cotyledon oppositifolia* Ledebour (1837) $\equiv$ *Sedum oppositifolium* (Ledebour) Hamet (1929) (*nom. illeg.*, Art. 53.1) $\equiv$ *Chiastophyllum oppositifolium* (Ledebour) Stapf ex A. Berger (1930).

[2] Herbs 15 - 30 cm; stems creeping, branched from the base and forming small tufts; **L** 6 - 8, decussate, not peltate, round-ovate, 2.5 - 4 $\times$ 1.5 - 4 cm, margin crenate-dentate, petiolate; **Inf** usually branching to become paniculate, arching over; **Fl** shortly pedicellate, pendent, campanulate, to 4 mm long; **Cl** lobes fused below into a short tube, yellowish-white to bright yellow.

Differs from all other species of *Umbilicus* in the absence of the tuberous rootstock and in the lack of peltate leaves. Several clones have been selected for their vigorous growth and/or bright flowers, e.g. 'Goldtröpfchen'. Recently, a variegated sport ('Frosted Jade') came into the trade.

U. paniculiformis Wickens (*KB* 33(3): 421-422, *ills.*, 1979). **T:** Sudan (*Andrews* 3579 [K]). – **D:** Sudan.

Incl. *Cotyledon arabicum* Schweinfurth ex Täckholm (1970) (*nom. inval.*, Art. 32.1c).

[1] Basal **L** orbicular, peltate, to 7 cm $\varnothing$, petiole to 14 cm, margin slightly crenate; cauline **L** similar but smaller, peltate to ovate-caudate; **Inf** lax, paniculiform, erect to suberect, to 25 cm; **Fl** erect; **Ped** 2 - 6 mm; **Cl** campanulate, white, 5 - 6 $\times$ 3.5 mm $\varnothing$, lobes ovate, 2.5 mm, $\pm$ as long as the fused basal portion of the tube.

This species, together with *U. tropaeolifolius*, is distinguished from the other species by the distinctive paniculate (as opposed to spicate) inflorescence. From *U. botryoides* it differs also by the branching of the inflorescence, the campanulate flowers and the deeper division of the **Cl**.

U. parviflorus (Desfontaines) De Candolle (*PSRV* 3: 400, 1828). **T:** Greece, Crete (*Tournefort* s.n. [P]). – **D:** Greece, Turkey, Aegean Islands. **I:** Sibthorp & Smith (1806-1840: 5: t. 445, 1825).

$\equiv$ *Cotyledon parviflora* Desfontaines (1808); **incl.** *Umbilicus sprunerianus* Boissier (1845); **incl.** *Umbilicus micranthus* Pomel (1876); **incl.** *Sedum mirum* Pampanini (1936) $\equiv$ *Umbilicus mirus* (Pampanini) Greuter (1981).

[1] Basal **L** orbicular, cordate or subpeltate, 2 - 5 cm Ø, margin sinuate or entire; **Inf** simple or branched erect racemes to 35 cm; **Fl** erect or spreading; **Ped** 1 - 2 mm; **Cl** yellow, tubular, 4 - 6 mm long, lobes to 2× as long as the tube.

Closely allied to *U. chloranthus*, but with less distinctly peltate leaves.

U. patens Pomel (Nouv. Mat. Fl. Atl., 324, 1876). – **D:** Algeria, Morocco?.

≡ *Cotyledon umbilicus-veneris* ssp. *patens* (Pomel) Battandier (1889).

[1] Very similar to *U. parviflorus*, if distinguishable at all; **Fl** drooping and smaller.

U. rupestris (Salisbury) Dandy (Fl. Gloucestershire, 611, 1948). – **D:** W and S Europe, Madeira, Azores, Egypt, Turkey, Cyprus. **I:** Berger (1930: fig. 200). **Fig. XLVIII.e**

≡ *Cotyledon rupestris* Salisbury (1796); **incl.** *Cotyledon umbilicus-veneris* var. *tuberosa* Linné (1753) ≡ *Cotyledon tuberosa* (Linné) Halácsy (1901); **incl.** *Cotyledon umbilicata* Lamarck (1779) ≡ *Umbilicus umbilicatus* (Lamarck) Breistroffer (1974); **incl.** *Cotyledon pendulina* De Candolle (1805) ≡ *Umbilicus pendulinus* (De Candolle) De Candolle (1832) ≡ *Cotyledon umbilicus-veneris* ssp. *pendulina* (De Candolle) Battandier (1889); **incl.** *Umbilicus vulgaris* Battandier & Trabut (1905); **incl.** *Umbilicus pendulinus* var. *truncatus* Wolley-Dod (1914) ≡ *Umbilicus rupestris* var. *truncatus* (Wolley-Dod) G. D. Rowley (1956); **incl.** *Cotyledon neglecta* Coutinho (1939) ≡ *Umbilicus neglectus* (Coutinho) Rothmaler & P. Silva (1940); **incl.** *Umbilicus pendulinus* var. *velenovskiyi* Rohlena ex H. Jacobsen (1954) ≡ *Umbilicus rupestris* var. *velenovskiyi* (Rohlena ex H. Jacobsen) G. D. Rowley (1956).

[1] Basal **L** orbicular, peltate, concave above, 1.5 - 7 cm Ø, margin crenate; cauline **L** reniform to linear, margin dentate; **Inf** usually simple dense racemes, erect, to 50 cm; **Fl** drooping; **Ped** 3 - 9 mm; **Cl** tubular, 6 - 10 mm long, to 4× the length of the free lobes, whitish-green or straw-coloured, sometimes tinged pinkish; lobes ovate-acuminate, to 1.5 - 2.5 (-3) mm. – *Cytology:* 2n = 48.

This is the common "Navelwort" or "Pennywort", widely distributed in W and S Europe and usually found on walls or banks, i.e. on free-draining substrates. It is a very variable species, such that some variants may require recognition at subspecific level, e.g. *U. neglectus* from the Iberian Peninsula. In the N of its range the corolla is usually larger (7 - 10 mm) and hence distinct from *U. horizontalis*. In the S and SE the corolla is shorter (6 - 7 mm) and hence closer to the latter taxon with which it is easily confused. The flowers of *U. rupestris* are usually drooping, but horizontally spreading in *U. horizontalis* var. *horizontalis*.

The correct name for this taxon may be *U. umbil-*

icatus, but this issue, like other nomenclatural problems relating to *Umbilicus*, remains unresolved at present.

U. schmidtii Bolle (Bonplandia 7: 245, 1859). – **D:** Cape Verde Islands; endemic.

Incl. *Umbilicus horizontalis* J. A. Schmidt (1852) (*nom. illeg.*, Art. 53.1).

[1] Basal **L** orbicular, peltate, petioles long, margin entire to slightly crenate; cauline **L** with progressively shorter petioles, eventually sessile; **Inf** loose erect racemes, sometimes branched, to at least 30 cm; lower **Bra** narrowly lanceolate, upper **Bra** linear, acute; **Fl** distant, spreading, erect or pendulous; **Ped** extremely short; **Cl** tubular, dull dirty yellow, lobes lanceolate, acute.

The relationships with *U. horizontalis* require investigation.

U. tropaeolifolius Boissier (Diagn. Pl. Orient. 1(3): 14, 1843). **T:** Iraq (*Aucher-Eloy* 2658 [G]). – **D:** SE Turkey, N Iraq, W Iran, Somalia. **Fig. XLVIII.b** ≡ *Cotyledon tropaeolifolia* (Boissier) Bornmann (1914); **incl.** *Umbilicus oxypetalus* Boissier (1843).

[1] Lax ascending or procumbent herbs; **Br** to 30 cm, branched, fragile and delicate; basal **L** orbicular, peltate, margin subentire, to 4 cm Ø; cauline **L** peltate or ovate with cordate base; **Inf** lax much-branched decumbent panicles; **Fl** spreading; **Ped** 2 - 6 mm; **Cl** cream to white, 4 - 5 mm long and Ø, stellate-campanulate, lobes to ± 2× the length of the tube.

This species, together with *U. paniculiformis*, may be distinguished from the others of the genus by the distinctive paniculate (as opposed to spicate) inflorescences.

VILLADIA

J. Thiede

Villadia Rose (Bull. New York Bot. Gard. 3(9): 3, 1903). **T:** *Cotyledon parviflora* Hemsley. – **Lit:** Uhl (1994c); Uhl & Moran (1999). **D:** S USA (SW Texas), Mexico (Chihuahua to Chiapas), Guatemala (Baja Verapaz), Peru; mountainous and highland regions, esp. rocky places, (600-) 1500 - 4000 m. **Etym:** For Dr. Manuel M. Villada (1841 - 1924), Mexican physician and naturalist.

Perennial herbs or small shrubs, mostly glabrous; **R** thickened-fusiform or fibrous; stems mostly more richly branched near the base or up to ½ their length, 5 - 60 (-90) cm, either largely woody and persistent and mostly ± erect (then small shrubs), or herbaceous, only basally becoming woody and ± decumbent-ascending (then mat-forming herbs), or herbaceous and short-lived, ± annual, ± erect, dying ± back after flowering to the mostly short persistent and woody stem base (then geo- or hemicryp-

tophytes with thickened persistent **R**); **L** alternate, mostly $\pm$ spreading to ascending and $\pm$ oblong-lanceolate to linear, usually terete-subulate and straight, acute or obtuse, basally (always?) $\pm$ conspicuously spurred, mostly smooth, (3-) 6 - 23 (-40) $\times$ (1-) 1.5 - 3 (-15) mm, normally $\pm$ green; **Inf** $\pm$ erect spikes, racemes or mostly thyrses, 2 - 20 (-40) cm, with 6 - 70 (-150) scorpioid **Br** with 2 - 5 (-8) **Fl**; **Fl** 5-merous (rarely 4-merous), obdiplostemonous; **Ped** (almost) absent or very short, often (always?) with 2 bracteoles; **Sep** (almost) free, ascending to $\pm$ spreading, $\pm$ oblong-lanceolate or -ovate, obtuse or acute, basally (always?) $\pm$ spurred, usually (almost) equal, 1 - 4.5 (-7) $\times$ 1 - 2 (-2.5) mm, normally green; **Cl** variable in shape, 3 - 8 mm $\varnothing$, basally often (always?) pentagonal; **Pet** $\pm$ ovate to elliptic-oblong, dorsally frequently (always?) keeled, 3 - 6 (-9) $\times$ 1.2 - 2 (-3) mm, normally $\pm$ whitish to rose-coloured, tube 0.5 - 1.7 (-4) mm, lobes mostly spreading to reflexed or erect, $\pm$ ovate, triangular or lanceolate, acute to obtuse, subapically often (always?) $\pm$ conspicuously cuspidate (to 1.4 mm, normally shorter), equal or unequal, 2 - 5 $\times$ 1 - 2.6 (-3) mm; **St** in 2 series; **Fil** mostly erect and $\pm$ slenderly filiform, ($\pm$ 1-) 1.7 - 3.4 (-6) mm long overall, basally united with the **Cl** tube for 0.6 - 2.8 (-4) mm; **Anth** usually (pale) yellow; **NSc** variable in shape and size, to 2 $\times$ > 1 mm but normally much smaller, basally often attenuate, (pale) yellow to orange; **Ca** erect, later $\pm$ divergent, thickish to slender, (2.3-) 2.5 - 6 (-6.5) $\times$ (0.6-) 0.75 - 1.1 (-1.3) mm, basally united for (0.4-) 0.5 - 1 (-1.25) mm, green to greenish or white; **Sty** slender to thickish, mostly $\pm$ recurved, 0.5 - 2 (-2.5) mm, normally green or white; **Fr** follicles; **Se** $\pm$ fusiform, $\pm$ brown, testa centrally-papillose (always?). – *Cytology*: $n = 9-17, 20-22, 33$, and higher.

Moran (1996) limits the genus *Villadia* to the original concept of Rose and places the species of the former Sect. *Altamiranoa* (Rose) Baehni & Macbride (= *Altamiranoa* Rose) in the genus *Sedum*; this concept is here followed. Moran justifies his decision with the intermediates between *Altamiranoa* and *Sedum* and with the lack of certainty about a close relationship between *Villadia* s.str. and *Altamiranoa*, which is moreover consistent with cytological data (hybridization experiments) (Uhl & Moran 1999). *Villadia* is now better delimited from *Sedum*. It is distinguished primarily by the petals basally fused into a normally conspicuous tube (petals usually free or rarely forming a short tube in *Sedum*), and even more by the shape of the inflorescences (mostly cymose for *Sedum*, older reports of 'panicles' for *Villadia* are presumably erroneous, and such inflorescences are here described as thyrses).

The complex cytology of *Villadia* (chromosome numbers fairly constant within species, but very different between species) with a hypothetical series of descending dysploidy has been elucidated

by Uhl & Moran (1999). These authors assume a basal position for the species here included in the *V. guatemalensis* group exhibiting a more woody habit and larger flowers with short tubes, spreading segments and long styles, and with more but smaller chromosomes. These are regarded as closest to and possibly derived from *Sedum* Sect. *Fruticisedum*, with which they share the woody habit and the higher chromosome numbers. In contrast, *Villadia* species with more herbaceous above-ground parts and flowers with longer tubes, erect lobes and abruptly reflexed and short styles as well as fewer and larger chromosomes (here placed in the *V. painteri* group) are regarded as more derived by the same authors. Consequently, *Villadia* might have migrated N-wards into the more arid regions of the Mexican Plateau, coupled with general evolutionary trends towards reduction of the woody habit and the development of storage roots, a reduction in flower size with increasing tube length, upright corolla segments and short recurving styles, as well as a dysploid reduction of the chromosome number.

Intergeneric hybrids are known with the following genera: *Cremnophila* (= $\times$ *Cremnadia*), *Echeveria* (= $\times$ *Villeveria*), *Graptopetalum* (= $\times$ *Graptoladia*), *Pachyphytum* (= $\times$ *Pachyladia*), *Sedum* (= $\times$ *Sedadia*).

Villadia can be informally classified as follows, mainly based on characteristics of the flowers:

- [1] *V. guatemalensis* Group: **L** at least apically papillose; **Fl** of medium size; **Pet** 3.5 - 6 mm, lobes spreading to recurved; **Ca** green (to greenish); **Sty** slender, rather long, 1.1 - 2.5 mm, slightly curved back (C and S Mexico, Guatemala; 3 species).
- [2] *V. pringlei* Group: **Fl** relatively large; **Pet** 6 - 9 mm, lobes spreading to recurved, acute (rarely obtuse); **Sty** to 2 (-3) mm (N, C and S Mexico; 4 species).
- [3] *V. squamulosa* Group: Stems $\pm$ roughly papillose; **Fl** relatively small; **Pet** 2 - 4 mm, lobes spreading to recurved; **Sty** rather short, 0.5 - 1.5 mm (N, C and S Mexico; 4 species). – This group with spreading but rather short styles is intermediate between groups 1 - 2 and 4 - 7.
- [4] *V. albiflora* Group: Woody small shrubs; stems slender; **L** distant, spreading; **Pet** erect; **Fil** thickish-rounded, not filiform; **Anth** violet; **Sty** very short, thick, conical, $\pm$ 0.2 mm, partly purplish (S Mexico; 1 species).
- [5] *V. imbricata* Group: Mat-forming herbs; **L** appressed, papillose, densely imbricate; **Fl** relatively small; **Pet** 3 - 4 (-5) mm, thickish, lobes erect, hardly opening; **Sty** slender, erect, $\pm$ 0.8 mm (S Mexico; 1 species).
- [6] *V. painteri* Group: Herbs with annual flowering **Br** and thickened **R**; **Pet** lobes erect; **Sty** (very) short, $\leq$ 0.5 - 0.8 mm, abruptly reflexed (N and C Mexico; 5 species). – *V. cucullata* and *V. aristata* (**Pet** cucullate, marginally dentate and

mostly conspicuously aristate) form a distinct subgroup.

- [7] *V. virgata* Group: **L** ± ovate; **Inf** few-flowered spikes; **Pet** lobes erect; **Sty** short, ± 0.5 - 0.8 mm, mostly recurved; **NSc** rather large, 1.5 - 2 mm (unknown in *V. incarum*) (Peru; 3 species).

As an alternative to this break-down, *Villadia* could be divided in 2 groups according to growth form, distribution and chromosome numbers, but these groups are very heterogeneous as to flower characters and would presumably be artificial (A: above-ground stems persistent, small shrubs or mat-forming only basally woody herbs, only S of the Transmexican volcanic belt and in Peru; B: mostly geophytes or hemicryptophytes with thickened storage roots and short-lived flowering stems, S USA and Mexico N of the volcanic belt).

The author is deeply indebted to Reid Moran (USA) for valuable additional information.

V. acuta Moran & C. H. Uhl (CSJA 63(4): 200-202, ill., 1991). **T:** Mexico, San Luis Potosí (*Kinnach* 296 [BH 372699, HNT, SD]). – **D:** Mexico (San Luis Potosí); moss-covered rocks, 1700 m, only known from the type locality.

[2] Herbs; **R** thickened-fusiform, several, to 20 × 5 mm; stems erect, flowering **Br** 10 - 30 cm, only partly deciduous, base branched and woody-persistent, ≥ 15 × 0.5 cm; **L** spreading or somewhat curved downwards, subulate, acutely pointed, spurred, apically somewhat papillose, 10 - 20 × 1.5 - 3 mm; **Inf** dense spikes or thyrses, 3 - 10 cm, with 10 - 40 **Br** with 1 (-3) **Fl**; **Ped** absent; **Sep** ascending-spreading, lanceolate, acute, spurred, 3.5 - 4 × 1 mm; **Cl** pentagonal, 5 - 8 mm Ø; **Pet** 7 - 9 × 1.5 - 2 mm, white, tube 3.5 - 4 mm, lobes recurved, very acute, subapically aristate, 3.5 - 5 × 1.5 - 2 mm, uppermost ± 2 mm yellowish-green; **St** 5.6 - 6.7 mm; **Fil** basally united with the **Cl** tube for ± 4 mm, white; **NSc** oblong-cuneate, obliquely acute, ± 0.7 × 0.5 mm, pale yellow; **Ca** slender, 5 - 6 × 1.1 - 1.25 mm, basally united for 1.25 mm, white; **Sty** slender, 1.5 - 2 mm. – *Cytology*: n = 16.

Distinguished from all other species by the long corolla tube. Most closely related to *V. diffusa* and *V. pringlei* according to the protologue.

V. albiflora (Hemsley) Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 30, 1905). **T:** Mexico, Oaxaca (*Galeotti* 2810 [K]). – **D:** Mexico (Puebla, Oaxaca). **I:** KuaS 44: 242, 1993. **Fig. XLVIII.h**

≡ *Cotyledon albiflora* Hemsley (1878) ≡ *Altamiranoa albiflora* (Hemsley) E. Walther (1938); **incl.** *Villadia ramosissima* Rose (1903) ≡ *Altamiranoa ramosissima* (Rose) E. Walther (1938).

[4] Small shrublets; stems first erect but later spreading to decumbent, basally richly branched, to 40 cm, young apically farinose-glaucous, later ±

reddish to red-brownish; **L** distant, almost horizontally porrect, ovate to somewhat oblong, almost terete, obtuse, ± 6 - 11 × 2 - 3 mm, young farinose, later green or usually at least apically or ± completely reddish-tinged; **Inf** usually lax spikes or thyrses, 2 - 5 cm; **Ped** absent or very short; **Sep** broadly ovate, acute or obtuse, all equal, ± 3 × 2.5 mm, pale green, apically ± reddish, somewhat farinose; **Cl** campanulate to ± tubular, pentagonal; **Pet** dorsally keeled, 5 - 6 mm, pure white or slightly tinged with rose, tube ± 1 mm, lobes erect, subapically somewhat aristate, ± 4 - 5 × 2.5 mm; **St** ± 3.5 mm; **Fil** over the whole length thickish-rounded, not filiform, basally to 1 mm united with the **Cl** tube; **Anth** purplish; **NSc** broadly rectangular, basally slightly attenuate, ± 0.8 × 1 mm, yellowish, apically ± brown; **Ca** ± 3 × 1.3 mm, basally united for ± 1 mm, white; **Sty** very short, ± 0.2 mm, partly purplish; **Sti** greenish. – *Cytology*: n = 15.

Uhl & Moran (1999) interpret *V. ramosissima* as a synonym, and the holotype of *V. albiflora* is regarded as a specimen abnormally branching after injury (Moran, in lit.). Purplish anthers and thickish-rounded non-filiform filaments are not known from any other species.

V. aperta Moran & C. H. Uhl (Cact. Suc. Mex. 37(2): 31-34, ill., 1992). **T:** Mexico, Durango (Uhl 2255 [BH]). – **D:** Mexico (Durango); only known from the type collection.

[3] Herbs; **R** thickened; stems usually erect, somewhat roughly papillose, 20 - 30 cm; **L** spreading, linear, inconspicuously cylindrical, abruptly pointed, shortly spurred, apically papillose, 15 - 23 × 3 mm, green, not glaucous; **Inf** lax thyrses, 12 - 18 cm with 10 - 20 **Br** with (1-) 2 - 4 **Fl**; **Ped** 1 - 3 mm; **Sep** ascending to spreading, oblong-elliptic, acutish, shortly spurred, somewhat papillose, unequal, 3 - 7 × 1 - 2.5 mm; **Cl** broadly funnel-shaped, 7 - 8 mm Ø; **Pet** 4 mm, pale yellowish-green, almost white, tube 1 mm, lobes spreading from above the middle, ovate-triangular, acute, subapically aristate, ± 3 × 3 mm; **St** 2.5 - 3 mm; **Fil** basally united with the **Cl** tube for 1 mm; **NSc** fan-shaped, 0.8 × 0.2 (basally) - 1 (apically) mm, yellow-orange; **Ca** 3.5 - 4.5 × 0.75 - 1.1 mm, green; **Sty** somewhat recurved, 1 - 1.5 mm. – *Cytology*: n = 15.

Distinguished from all other species by the broadly funnel-shaped flowers with ovate-triangular petal lobes. Related more closely to *V. squamulosa* and *V. minutiflora* according to the protologue. Within the *V. squamulosa* Group, the species is intermediate to the *V. guatemalensis* Group by virtue of its somewhat larger flowers and longer styles.

V. aristata Moran (CSJA 62(4): 177-182, ill., 1990). **T:** Mexico, San Luis Potosí (Moran 10006 [SD, CAS, CU, K, MEXU, NY, US]). – **D:** Mexico (Coahuila, Nuevo León, Tamaulipas, San Luis Potosí); oak and conifer forests, dwarf forests, open

alpine meadows, granite or mostly limestone, 2200 - 3800 m.

[6] Herbs; **R** thickened, 2 - 3 (-5) mm Ø; stems deciduous after flowering, mostly unbranched, 10 - 30 cm; **L** ascending, oblong-lanceolate to oblong-obspatulate, acute, spurred, papillose near tip, 8 - 16 (-27) × 2 - 3.5 mm, greyish-green; **Inf** dense spikes, racemes or thyrses, 3 - 20 cm, **Br** short and clustered, lower to middle **Br** with up to 2 **Fl**; **Ped** 1 mm; **Sep** broadly lanceolate, acute, hardly spurred, papillose, somewhat unequal, 3.5 - 4.5 (-5) × 1.5 - 2 mm; **Cl** ellipsoid to inconspicuously globose, 4 - 5 (-7) × 3 - 4 (near mouth 1 - 2) mm; **Pet** dorsally keeled, 3.1 - 3.7 (-4.5) mm, greenish below, white to rose or lavender above, tube 0.6 - 0.9 (-1.7) mm, lobes erect, ± cucullate, rounded, 2.7 - 3.2 × 1 mm, margin irregularly dentate, keel extending into a subapical 1 - 1.4 mm long awn; **St** 2.4 - 3 mm; **Fil** basally united with the **Cl** tube for 0.6 - 0.9 mm, whitish; **NSc** cuneate, 0.7 - 0.9 × 0.3 (basally) - 0.6 (apically) mm, orange-yellow; **Ca** 2.7 - 3 × 0.8 - 1.1 mm, basally united for 0.6 - 0.7 mm, green; **Sty** somewhat recurved, 0.5 mm. - *Cytology*: n = 10.

Distinguished from all other species by the long- aristate petal tips. According to the protologue, the closest relationships exist to *V. cucullata*.

V. cucullata Rose (Bull. New York Bot. Gard. 3(9): 4, 1903). **T**: Mexico, Coahuila (*Palmer* 374 [US 336367]). - **D**: Mexico.

≡ *Cotyledon cucullata* (Rose) Fedde (1904) ≡ *Altamiranoa cucullata* (Rose) E. Walther (1938).

V. cucullata ssp. **apiculata** Moran & C. H. Uhl (CSJA 70(4): 201-202, ill., 1998). **T**: Mexico, San Luis Potosí (*Moran* 6343 [SD, CU]). - **D**: Mexico (Hidalgo, Nuevo, León, Tamaulipas, San Luis Potosí); limestone rocks (exclusively?), 600 - 1800 m. **I**: Walther (1937: 151, as *V. cucullata*).

[6] Differs from ssp. *cucullata*: **Pet** oblong-obovate, acutish, strongly keeled, keel extending into a subdorsally attached 0.3 - 0.7 mm long mucro, inner **Pet** apically sometimes broader than the outer and narrowly cucullate. - *Cytology*: n = 11, 21+1.

According to the protologue so far sometimes confused with ssp. *cucullata* (e.g. by Walther (1937)).

V. cucullata ssp. **cucullata** - **D**: Mexico (Coahuila, Nuevo León); dry rocks, on limestone and gypsum, 1200 - 2400 m.

Incl. *Villadia jimulcensis* G. L. Nesom (1988).

[6] Herbs; **R** tuberously thickened, to 1 cm Ø; stems few, often solitary, annual, erect, stiff, 20 - 50 (-90) cm, basally reddish or densely striped with red, above sometimes pure red, base short, woody-persistent, to 7 mm Ø; **L** mostly strongly ascending, subulate, acute, pointed, papillose towards tips, spurred, lower **L** 10 - 35 × 2 - 4 (-7) mm, upper **L** becoming smaller and smaller, pale green; **Inf**

dense thyrses, or spicate above, 5 - 20 (-40) cm, with 25 - 100 (-150) short clustered **Br** with 1 - 2 (-5) **Fl**; **Ped** (almost) lacking; **Sep** triangular-lanceolate, apically papillose, all almost equal, 2 - 4 × 0.6 - 1.3 mm, green or violet; **Cl** almost closed and enclosing **St** and **Ca**; **Pet** elliptic-oblong, 3 - 5 mm, weakly keeled, red or yellow with red or orange pattern, tube 1 - 2 mm, lobes erect, cucullate, rounded, margins near tips papillose to finely denticulate, without mucro; **NSc** cuneate-truncate, ± 0.6 × 0.6 mm, yellow-orange; **Ca** 2 - 2.5 mm, greenish, basally united for 0.5 - 1 mm; **Sty** erect, conical, 0.5 mm. - *Cytology*: n = 11.

V. jimulcensis is here placed in synonymy according to Moran & Uhl (1998). A plant needing further studies but similar to *V. cucullata* with brownish corollas and a chromosome number of n = 10 is reported from NW Querétaro by Uhl & Moran (1999).

V. diffusa Rose (CUSNH 13: 302, 1911). **T**: Mexico, Chiapas (*Collins & Doyle* 131 [US 574298, NY]). - **D**: Mexico (Chiapas); mountain regions, 1800 - 2500 m.

≡ *Altamiranoa diffusa* (Rose) E. Walther (1936).

[2] Herbs; stems richly branched, erect to decumbent, basally somewhat woody, to 40 cm, purplish; **L** triangular-ovate to oblong, mostly broadest near the base, obtuse, 5 - 12 × 2 - 2.5 mm, forming small **Ros** on young **Br** or densely imbricate and covering the stems; **Inf** spikes, 2 - 12 cm, with 5 - 20 **Fl**; **Sep** ovate, obtuse, 2.5 - 4 × 1.5 - 2.5 mm; **Pet** triangular-ovate, 4 - 5 × 2 - 2.5 mm, rose-coloured, tube 2 - 2.5 mm, lobes acute, recurved, 4 - 5 × 2 - 2.5 mm; **Ca** 5 - 6 mm; **Sty** slender, 1.5 - 2.5 mm.

A poorly known species.

V. dyvrandae (Hamet) Baehni & Macbride (Candollea 7: 286, 1937). **T**: Peru, Lima (*Weberbauer* 5278 [B†]). - **D**: Peru (Cajamarca, Cuzco, La Libertad, Lima); rocky slopes, 2000 - 3500 m.

≡ *Sedum dyvrandae* Hamet (1914) ≡ *Altamiranoa dyvrandae* (Hamet) A. Berger (1930); **incl.** *Sedum backebergii* von Poellnitz (1939).

[7] Herbs; **R** fibrous; stems basally somewhat decumbent, then ascending, branching mostly above ½, rarely unbranched, flowering stems 5 - 9 cm, sterile stems 0.4 - 2 cm; **L** elongate-ovate, somewhat obtuse, with an obtuse spur, 3.3 - 7.5 × 1.5 - 2.8 mm; **Inf** very lax spikes, few-flowered, 1.5 - 2.5 cm; **Ped** very short; **Sep** ovate-oblong, somewhat obtuse, spurred, 4.7 - 6.5 × 2.2 - 2.8 mm; **Pet** dorsally keeled, 4.85 mm, greenish, tube 1.2 mm, lobes probably erect, broadly ovate, ± obtuse, subapically aristate, 3.65 × 2.6 mm; **St** 3.5 - 3.6 mm; **Fil** basally fused with the **Cl** tube for 1 - 1.1 mm; **NSc** obscurely linear, apically widened and concave, 1.6 × 1 mm; **Ca** 3.6 mm, basally united for 1 mm; **Sty** 0.6 mm.

According to the protologue obviously similar to

and perhaps conspecific with *V. virgata*, esp. because of the large nectary scales that are otherwise unknown in the genus (with the exception of *V. squamulosa*). *Sedum backebergii* is here synonymized with a question mark.

V. guatemalensis Rose (CUSNH 12(9): 396, 1909). **T:** Guatemala, Baja Verapaz (*Maxon & Hay* 3411 [US 473398]). – **D:** Mexico (Oaxaca), Guatemala (Baja Verapaz, Sololá). **I:** CUSNH 12(10): t. 81, 1909; Clausen (1951); KuaS 44: 242, 1993; Cact. Suc. Mex. 43: 90-92, 1998. **Fig. XLVIII.f, XLVIII.g**

≡ *Altamiranoa guatemalensis* (Rose) E. Walther (1938); **incl.** *Villadia levis* Rose (1909) ≡ *Altamiranoa levis* (Rose) E. Walther (1938).

[1] Shrublets; stems ± strictly erect to divaricately fastigiate or ascending to decumbent, flowering stems erect or ascending, finely papillose, 30 - 50 cm, deciduous ± in the upper ½, richly branched in the lower ½, base becoming woody and persistent, sterile stems short, with **L** densely arranged and **Ros**-like; **L** linear, ± perpendicularly spreading but ± curved upwards, almost blunt or ± acute, apically and along the dorsal keel delicately papillose, 5.6 - 23 × 2.4 - 3.2 mm, pale yellowish-green, sometimes spotted with rose or red; **Inf** lax thyrses, elongate, to 28 cm, with 5 - 70 scorpioid **Br**; **Fl** rarely only 4-merous; **Sep** almost free, oblong-ovate, apically finely papillose, unequal, 3 - 3.4 × 1.2 - 1.6 mm, green; **Cl** basally pentagonal, 8 - 9 mm Ø; **Pet** dorsally finely papillose and keeled, 4.2 - 6 × 1.2 - 2 mm, greenish-yellow to white, often strongly red-spotted, tube 1 - 1.4 mm, lobes broadly spreading to recurved, lanceolate, obtuse, spotted with reddish in the upper ½, with white marginal fringe; **St** 1.4 - 3.8 mm; **Fil** basally united with the **Cl** tube for 0.6 - 1.5 mm, pale green, sometimes apically flushed with rose; **NSc** broadly reniform to spatulate, rounded; **Ca** 6 - 6.5 mm, basally united for 0.5 mm, green; **Sty** slender, somewhat recurved, ± 2 mm, ± reddish. – *Cytology*: n = 20, 21.

Very variable in its growth form. Frequently cultivated.

V. imbricata Rose (Bull. New York Bot. Gard. 3(9): 3-4, 1903). **T:** Mexico, Oaxaca (*Nelson* 1767 [US, NY]). – **D:** Mexico (Puebla, Oaxaca); ± 700 m. **I:** KuaS 44: 241, 1993.

≡ *Cotyledon imbricata* (Rose) Fedde (1904) ≡ *Altamiranoa imbricata* (Rose) E. Walther (1938) (*nom. illeg.*, Art. 53.1); **incl.** *Altamiranoa ericoides* H. Jacobsen (1955).

[5] Herbs; stems ± decumbent-ascending, mat-forming, at the most basally somewhat woody, flowering stems 2 - 10 (-15) cm, sterile stems shorter; **L** appressed, ovate, curved inwards, acute, upper face ± flattish, lower face keeled, young conspicuously and later somewhat papillose, 3 - 8 (-12) × 2 - 4 mm, pale green, young glaucous, flowering stems

laxly leafy, sterile stems densely imbricately leafy; **Inf** dense spikes or thyrses, ± 1 - 4 (-8) cm, basal **Br** sometimes with 2 **Fl**, overall with 8 - 20 **Fl**; **Ped** of basal **Fl** very short, otherwise absent; **Sep** elliptic, appressed, obtuse, apically somewhat papillose, unequal, 2.5 - 4 × 1.2 - 1.5 mm; **Cl** weakly pentagonal-ovoid, hardly opening; **Pet** ovate, rather thick, dorsally keeled, acute, 3 - 4 (-5) × 1.2 mm, white, tube 0.8 - 1.7 mm, lobes erect, hardly spreading, acute, subapically somewhat aristate, ± 2.7 - 3.3 mm; **St** 2.3 - 2.8 mm; **Fil** basally fused with the **Cl** tube; **Anth** ± 0.5 - 0.6 mm; **NSc** broadly truncate-cuneate, ± 0.7 × 0.4 (basally) to 0.8 - 1 (apically) mm; **Ca** ± 2.8 × 1 mm, basally fused for ± 0.5 mm; **Sty** slender, erect, ± 0.8 mm. – *Cytology*: n = 12.

Diagnostically characterized by the imbricate foliage. Frequently cultivated.

V. incarum (Ball) Baehni & Macbride (Candollea 7: 286, 1937). – **D:** Peru (Lima, Ancash); on rocky slopes, 3500 - 4000 m.

≡ *Cotyledon incarum* Ball (1885) ≡ *Altamiranoa incarum* (Ball) A. Berger (1930); **incl.** *Cotyledon incarum* Ball (1885) (*nom. inval.*, Art. 61.1).

[7] Herbs; stems erect, basally branched, 16 - 21.5 cm, lateral **Br** short, densely leafy; **L** ovate-cylindrical, terete; **Inf** short racemes, erect, 8- to 12-flowered; **Ped** of lower **Fl** short, otherwise absent; **Sep** ovate-lanceolate, green with paler margins; **Cl** somewhat tubular; **Pet** linear-lanceolate, acute, 1.5× as long as the **Sep**, pale yellow or pale reddish, tube ½ - ⅓ of the **Pet** length. – *Cytology*: n = 88-89.

The spelling 'incanum' (Lat., ash-grey) is used in the protologue, but there is nothing grey mentioned for the plants, and the epithet was later corrected to 'incarum' in the errata.

V. laxa Moran & C. H. Uhl (Cact. Suc. Mex. 40(2): 31-33, ill., 1995). **T:** Mexico, Chihuahua (*Kimnach & Sánchez-Mejorada* 2091 [HNT, BH, US]). – **D:** Mexico (Sonora, Chihuahua, Sinaloa); rocks in mountain forests, 1900 - 2300 m.

[3] Herbs; **R** thickened, to 12 mm Ø; stems annual, at least apically roughly papillose, 10 - 30 × 0.3 cm, base short, woody and persistent, to 5 × 0.6 cm; **L** lanceolate, subulate, obscurely pointed, spurred, apically papillose, 5 - 35 × 2 - 4 mm, greyish; **Inf** lax spikes or thyrses, 5 - 20 × 1 - 2.5 cm, with 10 - 30 scorpioid **Br** 0.5 - 3 cm long with 1 - 4 **Fl** each; **Ped** absent or to 2 mm; **Sep** erect, lanceolate, obscurely pointed, spurred, apically papillose, somewhat unequal, 2.5 - 3.5 × 1 - 1.5 mm; **Cl** 4 - 6 mm Ø; **Pet** seemingly spreading, dorsally keeled, 3 mm, pale rose with paler margins, tube ± 1 mm, lobes ovate, acute, subapically aristate, 2 × 1.5 - 2 mm; **St** ± 1.9 mm; **NSc** ± 0.7 mm broad, reddish when dry; **Ca** 2.5 × ± 0.75 mm; **Sty** ± 0.5 mm. – *Cytology*: n = 14.

Probably closest to *V. minutiflora* and *V. squamu-*

losa according to the protologue. The protologue erroneously stated the type locality to be in Sinaloa, which was later corrected (Uhl & Moran 1999).

V. minutiflora Rose (Bull. New York Bot. Gard. 3(9): 4-5, 1903). **T:** Mexico, Oaxaca (*Pringle* 4981 [US 396661, NY]). – **D:** Mexico (Oaxaca); 2550 m.

≡ *Cotyledon minutiflora* (Rose) Fedde (1904) ≡ *Altamiranoa minutiflora* (Rose) E. Walther (1938).

[3] Dwarf shrublets; stems ascending or erect, unbranched, somewhat roughly papillose, originating from a richly branched woody base, 10 - 20 (-35) cm; **L** ascending, linear, terete, obtuse, spurred, shortly stiff-hairy, 6 - 10 × 1 mm, very numerous; **Inf** spikes, racemes or lax thyrses with short unilateral **Br**; **Ped** (almost) absent; **Sep** stiffly ciliate, somewhat unequal, 1.5 - 3 mm; **Pet** 3 mm, white or flushed with red, tube short, lobes spreading above the middle; **St** shorter than the **Pet**; **Fil** basally united with the **Cl** tube; **NSc** apically rounded, basally attenuate into a slender stalk; **Ca** short; **Sty** short, 0.4 - 0.5 mm, spreading or even hooked. – *Cytology*: *n* = 21.

Incompletely known. The species differs from all others of the genus by the short and stiff indumentum of the leaves and calyx segments.

V. misera (Lindley) R. T. Clausen (*Sedum* Trans-Mex. Volcanic Belt, 38, 1959). **T:** Mexico (*Dickson* s.n. [CGE]). – **D:** Mexico (border region Coahuila / Nuevo León, San Luis Potosí, Aguascalientes, Guanajuato, Querétaro, Hidalgo, México, Tlaxcala, Puebla). **I:** CSJA 64: 69-70, 1992.

≡ *Sedum miserum* Lindley (1838); **incl.** *Cotyledon parviflora* Hemsley (1878) (*nom. illeg.*, Art. 53.1); **incl.** *Villadia parviflora* Rose (1903); **incl.** *Altamiranoa parviflora* H. Jacobsen (1955).

[6] Herbs; **R** thickened; stems annual, erect, simple or somewhat branched, 20 - 40 × 0.2 - 0.3 cm, decumbent if longer; **L** oblong, appressed, lower **L** terete, scattered, upper **L** ovate-linear to linear-lanceolate, obscurely cylindrical, 10 - 20 mm, congested; **Inf** dense thyrses, 4 - 30 × 0.8 - 1.5 cm, with 20 - 70 short congested scorioid **Br** with 1 - 3 **Fl** each; **Sep** L-like, fleshy, almost equal, 2 - 5 × 1 - 2 mm; **Pet** ovate, almost hidden between the **Sep**, dorsally roughly keeled, 3 - 4 × 1 - 2 mm, white to somewhat rose-coloured, tube ± 1 mm, lobes erect, ovate, acute, somewhat cucullate, subapically conspicuously aristate; **St** ± 2.5 - 3 mm; **Fil** basally fused with the **Cl** tube for ± 1 mm; **NSc** apically concave, basally attenuate, slightly longer than broad; **Ca** roundish; **Sty** short, recurved. – *Cytology*: *n* = 33, 42-44, 48-49.

A cytologically variable species which needs further study. Clausen (1940) cites a collection of *V. parviflora* from Arizona, but this is based on cultivated material with possibly erroneous locality data. Calderón de Rzedowski (1974) indicates a

geographical range (without citing specimens) to Oaxaca. McDonald (1990) cites 2 specimens from the border region Coahuila / Nuevo León, not far N of the type locality of *V. stricta* in Zacatecas. This could, after further checking, make it necessary to include the latter species (see there) as a further synonym.

Uhl & Moran (1999) report a plant from SE Coahuila that is very similar to *V. misera* but has only *n* = 9 chromosomes, which is the lowest number in the genus. They also suggest that *V. misera* might have evolved from tetra- or hexaploids related to *V. painteri*, to which species it appears to be closest.

V. nelsonii Rose (Bull. New York Bot. Gard. 3(9): 4, 1903). **T:** Mexico, Guerrero (*Nelson* 2114 [US 48392]). – **D:** Mexico (Guerrero, Oaxaca); 1850 - 2550 m. **I:** CSJA 43: 84-87, 1971.

≡ *Cotyledon nelsonii* (Rose) Fedde (1904) ≡ *Altamiranoa nelsonii* (Rose) E. Walther (1938).

[1] Shrublets, densely papillose except inner **Fl** parts; **R** sometimes thickened; stems ± strictly erect, unbranched or few-branched in the lower ½, flowering stems dying back in the upper ½, 10 - 60 cm, bark not peeling; **L** spreading, spatulate, rounded, 15 - 40 (-50) × 5 - 15 mm, only present in the uppermost 2 - 5 cm of sterile stems, mostly deciduous after flowering; **Inf** lax spikes or thyrses, 3 - 18 cm, with 6 - 20 short scorioid **Br** with 1 - 3 **Fl** each; **Ped** almost absent; **Sep** ascending, oblong, ± acute, spurred, 2.5 - 3 × 1.25 - 1.5 mm; **Cl** pentagonal, basally campanulate; **Pet** dorsally keeled, 4 - 6 mm, white, keel greenish, tube 1 - 1.5 mm, lobes spreading, triangular, acute, dorsally papillose (except the margins), 3 - 4.5 × 1.5 - 2 mm; **St** 4.3 - 5.3 mm; **Fil** slowly tapering, basally fused with the **Cl** tube for 1 - 1.5 mm, **NSc** broadly spatulate, ± 0.6 × 0.5 - 0.6 mm; **Ca** 4 - 5 × 1.1 mm, basally fused for ± 0.8 mm, greenish; **Sty** slender, somewhat recurved, 2 - 2.5 mm. – *Cytology*: *n* = 20.

Distinguished from all other species of the genus by the spatulate broad and rather large leaves.

V. painteri Rose (North Amer. Fl. 22(1): 30, 1905). **T:** Mexico, Jalisco (*Rose & Painter* 7424 [US 451014]). – **D:** Mexico (Zacatecas, Jalisco, Guanajuato). **I:** CSJA 8: 151, 1937.

≡ *Altamiranoa painteri* (Rose) E. Walther (1938).

[6] Herbs; **R** thickened; stems short-lived, with some short erect dark blue-greenish **Br**, base short, woody-persistent; **L** ascending, tapering from the tip downwards and thus clavate, terete, obtuse, finely papillose, 5 - 15 (-25) mm, pale green, numerous and densely arranged, **Inf** rather lax spikes or on vigorous plants thyrses, 4 - 10 cm; **Sep** thickish, obtuse, 2.5 - 6 × 1 - 2.5 mm; **Pet** somewhat longer or as long as the **Sep**, white, dry ± rose-coloured, erect, obtuse; **Ca** thickish, ± acute; **Sty** very short, abruptly recurved. – *Cytology*: *n* = 15.

A little-known species.

V. patula Moran & C. H. Uhl (Cact. Suc. Mex. 36(2): 27-30, ill., 1991). **T:** Mexico, San Luis Potosí (Moran & Kimmach 7655 [SD 56962, CAS, CU, HNT, K, MEXU, MICH, MO, NY, TEX, US]). – **D:** Mexico (San Luis Potosí, Guanajuato, Querétaro); rocky slopes, 1950 - 2300 m.

[1] Herbs; **R** strongly thickened, to 80 × 5 mm; stems short-lived, erect, deciduous almost to the base, 10 - 60 cm, base woody-persistent, 5 cm; **L** ascending, lanceolate, obscurely cylindrical, acute, spurred, apically papillose, 7 - 21 × 2 - 3.5 mm, **Inf** lax thyrses, 5 - 30 × 1.2 - 1.8 cm, with 10 - 75 scorpioid **Br** with 1 - 4 (-8) **Fl** each; **Sep** ascending, appressed, triangular-lanceolate, acute, apically papillose, 2.5 - 3.5 × 1 - 1.5 mm; **Pet** spreading, 3.5 - 5 mm, white-greenish or somewhat reddish, tube 0.8 - 1.6 mm, lobes triangular-lanceolate, acute, 2.5 - 3.5 × 1.5 - 2.2 mm; **St** 3.2 - 4.2 mm; **Fil** basally united with the **Cl** tube for 2.1 - 2.8 mm; **NSc** trapezoid, 0.4 - 0.5 × 0.4 (basally) - 0.8 (apically) mm, orange to apically yellow; **Ca** 2.5 - 3 × 0.6 - 1.1 mm, basally fused for 0.4 - 0.6 mm, green; **Sty** somewhat recurved, 1.1 - 1.5 mm – *Cytology*: n = 13.

According to the protologue, *V. guatemalensis* with similar flowers and fruits is perhaps the closest relative. In habit, *V. misera* is most similar.

V. pringlei Rose (Bull. New York Bot. Gard. 3(9): 4, 1903). **T:** Mexico, Chihuahua (Pringle 1238 [US 48393, NY]). – **D:** Mexico (Chihuahua, Durango); mountain regions, 2000 - 2700 m.

≡ *Altamiranoa pringlei* (Rose) E. Walther (1938); **incl.** *Cotyledon neopringlei* Fedde (1904).

[2] Herbs; **R** fusiformly thickened; stems short-lived, deciduous to almost the short woody-persistent base, basally few-branched, 5 - 30 cm, green; **L** narrowly linear, acute to obtuse, upper face flat, lower face convex, spurred, 10 - 25 mm, glaucous; **Inf** dense spikes or thyrses, 2 - 13 cm, with 8 - 35 **Br** with up to 6 **Fl** each (mostly fewer), **Ped** absent or short (to 1.5 mm); **Cl** cup-shaped; **Sep** almost spreading to erect-spreading, acute to obtuse, somewhat unequal, the longer to 5 mm; **Pet** dorsally keeled, ± 6 mm, white, tips spreading to recurved, acute, subapically somewhat aristate; **Fil** erect or somewhat recurved, ± 5.5 mm; **Ca** slender, green or white; **Sty** slender, long, 1.25 - 2 mm, erect to diverging, white. – *Cytology*: n = 16.

A little-known species.

V. recurva Moran & al. (Cact. Suc. Mex. 43(1): 3-6, ill., 1998). **T:** Mexico, Oaxaca (Moran 10107 [SD 53445, ARIZ, BH, BM, CAS, CU, K, MEXU, MICH, MO, NY, RSA, TEX, US]). – **D:** Mexico (Guerrero, Oaxaca); mountain regions, 1600 - 2200 m.

[2] Herbs; **R** thickened; stems annual, erect or basally ± procumbent, leafy ± throughout, 20 - 30 cm, reddish, base short, persistent, somewhat woody, richly branched, to ≥ 3 × 0.5 cm; **L**

ascending to divergent, triangular-lanceolate, basally truncate and hardly spurred, acute, apically somewhat papillose, 8 - 13 × 2 - 3 mm, green or reddish, first glaucous; **Inf** spikes, 2 - 15 (-20) cm, with 5 - 25 **Fl**; **Ped** (almost) absent; **Sep** triangular-lanceolate, conspicuously shortly spurred, acutely pointed, somewhat to conspicuously unequal, 3 - 7 × 1.5 - 2.2 mm; **Pet** triangular-lanceolate, deeply canaliculate, lower ½ keeled, 7 - 9 mm, outside white or dark violetish, tube 1 - 1.5 mm, lobes triangular-ovate, narrowly pointed, recurved, 7 - 9 × 2 mm; **NSc** lunate, 1.25 mm broad; **Ca** 5 - 6 mm, greenish; **Sty** erect, slender, 2 - 3 mm. – *Cytology*: n = 14.

Similar to *V. diffusa* according to the protologue, but the leaves are acute, the sepals longer and acute, and the petals longer and more acute with a shorter tube. A possibly new species similar to *V. recurva*, but with n=12 only is reported from NW Oaxaca (Uhl & Moran 1999).

V. squamulosa Rose (Bull. New York Bot. Gard. 3(9): 5, 1903). **T:** Mexico, Chihuahua (Pringle 731 [K?]). – **D:** USA (SW Texas), Mexico (Chihuahua, Coahuila, N Zacatecas).

≡ *Altamiranoa squamulosa* (Rose) E. Walther (1938); **incl.** *Cotyledon parviflora* var. *squamulosa* S. Watson (1887) (*nom. inval.*, Art. 43.1); **incl.** *Sedum squamulosum* S. Watson (1887) (*nom. inval.*, Art. 29.1?).

[3] Herbs; **R** thickened, clustered; stems short-lived, erect or ascending, slender, basally branched, somewhat rough-papillose, 5 - 20 (-25) cm; **L** 20 - 70, linear, 10 - 25 × 1 - 3 mm; **Inf** lax spikes or thyrses with 10 - 30 **Br**; **Ped** absent or short; **Cl** small, open, 5 - 7 mm Ø; **Sep** elliptic-obovate, 1 - 3 mm; **Pet** ovate, 2 - 3 mm, rose-coloured, tube hardly 0.5 - 0.75 mm, lobes spreading from above the middle, acute; **NSc** conspicuous, cuneately fan-shaped, upper margin thickened, 1 - 1.5 mm, yellow; **Ca** short; **Sty** short, ± 0.5 mm. – *Cytology*: n = 17.

According the ICBN Art. 58.3, Ex. 2, Rose is the sole author for the combination *V. squamulosa*.

V. stricta Rose (in N. L. Britton & al. (eds.), North Amer. Fl. 22(1): 30, 1905). **T:** Mexico, Zacatecas (Palmer 512 [US]). – **D:** Mexico (Zacatecas); only known from the type collection.

≡ *Altamiranoa stricta* (Rose) E. Walther (1938) (*nom. illeg.*, Art. 53.1); **incl.** *Altamiranoa erecta* H. Jacobsen (1956).

[6] Herbs; stems erect, 10 - 20 cm, basally forming short dense **Ros**, pale green; **L** ascending, terete, obtuse, rather densely arranged; **Inf** elongate spikes, small; **Ped** absent; **Sep** obtuse, ± 1.5 mm; **Pet** 3 mm, white, becoming red in old specimens, probably spreading, broad and obtuse, subapically aristate; **St** ± 2 mm; **NSc** rather conspicuous, **Sty** short.

A little-known species. According to R. Moran

(in lit.) it is probably a synonym of *V. misera* (see there).

V. virgata (Diels) Baehni & Macbride (Candollea 7: 286, 1937). **T:** Peru, Ancash (*Weberbauer* 2853 (?) [B]). – **D:** Peru (Ancash, Cuzco); rocky slopes, 2000 - 4000 m. **I:** Quepo 9: 66, fig. 6, 1995.

≡ *Cotyledon virgata* Diels (1906) ≡ *Altamiranoa virgata* (Diels) A. Berger (1930).

[7] Shrublets; stems decumbent or strictly erect, several times branched, densely leafy, ± 20 - 25 cm, basally to ± 8 mm Ø, bark later peeling; **L** erect, sometimes almost appressed, ovate, semi-amplexicaul, spurred, 5 - 8 × 2 - 3 mm, not in **Ros** but densely arranged; **Inf** spikes; **Ped** mostly absent, sometimes short for the lowermost **Fl**; **Sep** narrowly triangular, 3 × 1.3 mm; **Pet** ovate, basally pouched, dorsally keeled, 4 - 5 × 2.5 mm, whitish, subapically aristate; **St** ± 4 mm; **NSc** conspicuous, oblong-spatulate, 1.5 - 2 mm; **Ca** 2.5 - 3.5 mm; **Sty** very short, ± 0.5 mm.

According to the protologue, *V. dyvrandae* (see there) is very similar. Moreover, both could probably be conspecific with *V. incarum*.

×VILLEVERIA

U. Eggli

×**Villevperia** C. H. Uhl (CSJA 66(5): 215, 1994).

= *Villadia* × *Echeveria*. Uhl (1994c) lists only the combination *V. grandisepala* × *E. chapalensis*. *V. grandisepala*, is, however, here treated as *Sedum grandisepalum*, and the hybrid generic name is therefore probably superfluous, because the hybrid is thus assignable to ×*Sedeveria*.

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- herrei → *Adromischus marianiae* var. *immaculatus*: 12
- heterophylla → *C. tomentosa* ssp. *ladismithensis*: 31
- – → *Kalanchoe laciniata*: 160
- hirtifolia → *Tylecodon hirtifolius*: 358
- hispanica → *Pistorinia breviflora*: 203
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- – fa. *flaviflora* → *Pistorinia hispanica*: 204
- – ssp. *cossoniana* → *Pistorinia brachyantha*: 203
- – var. *flaviflora* → *Pistorinia hispanica*: 204
- – – maculata → *Pistorinia hispanica*: 204
- – – purpurea → *Pistorinia hispanica*: 204
- hispida → *Sedum mucizonia*: 295
- hoerleiniana → *Tylecodon schaeferianus*: 361
- – var. *schaeferi* → *Tylecodon schaeferianus*: 361
- horizontalis → *Umbilicus horizontalis*: 365
- – var. *micrantha* → *Umbilicus horizontalis*: 365
- humilis → *Adromischus humilis*: 11
- – → *Dudleya cymosa* ssp. *paniculata*: 93
- imbricata → *Sedum reniforme*: 311
- – → *Villadia imbricata*: 371
- incanum → *Villadia incarum*: 371
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- insignis → *Kalanchoe elizae*: 155
- insularis → *Dudleya virens* ssp. *insularis*: 102
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- intermedia → *Umbilicus horizontalis* var. *intermedius*: 366
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- jacobseniana → *C. papillaris*: 31
- japonica → *Orostachys japonica*: 188
- jasminiflora → *Adromischus caryophyllaceus*: 9

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- jurgensenii → *Sedum jurgensenii*: 280
- laciniata → *Kalanchoe laciniata*: 160
- ladismithensis → *C. tomentosa* ssp. *ladismithensis*: 31
- lanceolata → *Dudleya lanceolata*: 96
- – → *Kalanchoe lanceolata*: 161
- – → *Kalanchoe spathulata*: 176
- – var. *saxosa* → *Dudleya saxosa*: 99
- lassithiensis → *Umbilicus erectus*: 365
- laxa → *Dudleya caespitosa*: 90
- – var. *cymosa* → *Dudleya cymosa*: 92
- – – nevadensis → *Dudleya cymosa* ssp. *cymosa*: 92
- – – paniculata → *Dudleya cymosa* ssp. *paniculata*: 93
- – – setchellii → *Dudleya setchellii*: 100
- leucantha → *Orostachys thyrsiflora*: 190
- leucophylla → *C. orbiculata* var. *oblonga*: 29
- leucothrix → *Tylecodon leucothrix*: 358
- libanotica → *Rosularia sempervivum* ssp. *libanotica*: 232
- – fa. *major* → *Rosularia sempervivum* ssp. *kurdica*: 232
- – var. *glabra* → *Rosularia sempervivum* ssp. *persica*: 233
- – – kurdica → *Rosularia sempervivum* ssp. *kurdica*: 232
- – – steudelii → *Rosularia sempervivum* ssp. *kurdica*: 232
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- linearis → *Dudleya linearis*: 96
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- linguifolia → *Cremnophila linguifolia*: 85
- linguiformis → *Dudleya caespitosa*: 90
- lingula → *Dudleya caespitosa*: 90
- lurida → *Dudleya lanceolata*: 96
- – → *Echeveria racemosa* var. *racemosa*: 122
- lusitanica → *Umbilicus erectus*: 365
- lutea → *Umbilicus erectus*: 365
- luteosquamata → *Tylecodon pearsonii*: 359
- macrantha → *C. orbiculata* var. *orbiculata*: 30
- – var. *virescens* → *C. orbiculata* var. *oblonga*: 29
- maculata → *Adromischus maculatus*: 11
- malacophylla → *Orostachys malacophylla*: 188
- – var. *boehmeri* → *Orostachys boehmeri*: 187
- – – japonica → *Orostachys malacophylla* var. *iwarenge*: 188
- mammillaris → *Adromischus mammillaris*: 12
- marianiae → *Adromischus marianiae*: 12
- marlothii → *Adromischus filicaulis* ssp. *marlothii*: 10
- mendocinoana → *Sedum laxum* ssp. *eastwoodiae*: 284
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- – ssp. *abylaea* → *Sedum mucizonia*: 295
- – – *ortegae* → *Sedum mucizonia*: 295
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- – – *glabella* → *Sedum mucizonia*: 295
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- – – *engleri* → *C. orbiculata* var. *orbiculata*: 30
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- – – *higginsiae* → *C. orbiculata* var. *orbiculata*: 30
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- – – *oophylla* → *C. orbiculata* var. *orbiculata*: 30
- – – **orbiculata**: 30
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- – – *tricuspidata* → *C. orbiculata* var. *orbiculata*: 30
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- – → *Dudleya lanceolata*: 96
- parviflora → *Umbilicus parviflorus*: 366
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- parvula → *Tylecodon reticulatus* ssp. *reticulatus*: 360
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- – var. *glaberrima* → *Rosularia sempervivum* ssp. *glaucophylla*: 232
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- plattiana → *Dudleya cymosa* ssp. *cymosa*: 92
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- praealta → *Umbilicus heylandianus*: 365
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- pseudogracilis → *C. papillaris*: 31
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- – → *Prometheum pilosum*: 206
- pulverulenta → *Dudleya pulverulenta*: 98
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- purpurea → *C. orbiculata* var. *spuria*: 30
- purpusii → *Dudleya cymosa* ssp. *cymosa*: 92
- pygmaea → *Tylecodon pygmaeus*: 360
- – var. *pygmaea* → *Tylecodon pygmaeus*: 360
- – – tenuis → *Tylecodon tenuis*: 362
- quitensis → *Echeveria quitensis*: 121
- racemosa → *Tylecodon racemosus*: 360
- ramosa → *C. orbiculata* var. *orbiculata*: 30
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- – var. *woodii* → *C. woodii*: 31
- reflexa → *Dudleya caespitosa*: 90
- repens → *Umbilicus erectus*: 365
- reticulata → *Tylecodon reticulatus*: 360
- retusa → *Echeveria fulgens*: 111
- – → *Sedum obtusatum* ssp. *retusum*: 301
- rhombifolia → *Adromischus* sp.: 8
- – var. *spathulata* → *Adromischus trigynus*: 14
- rigida → *Dudleya rigida*: 99
- rigidiflora → *Dudleya rigidiflora*: 99
- robusta → *Dudleya lanceolata*: 96
- rosea → *Echeveria rosea*: 122
- – → *Orostachys thyrsiflora*: 190
- roseana → *Dudleya cymosa* ssp. *pumila*: 93
- roseata → *Echeveria rosea*: 122
- rosettifolia → *Sedum nussbaumerianum*: 299
- rotundifolia → *Adromischus hemisphaericus*: 10
- rubens → *Dudleya rubens*: 99
- rubrovenosa → *Tylecodon rubrovenosus*: 361
- rudatisii → *C. orbiculata* var. *oblonga*: 29
- rugens → *Dudleya ingens*: 96
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- salmiana → *C. woodii*: 31
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- salzmännii → *Pistorinia breviflora*: 203
- – fa. *punctata* → *Pistorinia breviflora*: 204
- – – purpureo-apiculata → *Pistorinia breviflora*: 204
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- samium → *Rosularia serrata*: 233
- saxatilis → *Orostachys malacophylla* ssp. *malacophylla*: 188
- saxosa → *Dudleya saxosa*: 99
- schaeferi → *Tylecodon schaeferianus*: 361
- schaeferiana → *Tylecodon schaeferianus*: 361
- schaffneri → *Echeveria schaffneri*: 123
- scheeri → *Echeveria scheeri*: 123
- schonlandii → *Adromischus cristatus* var. *schonlandii*: 10
- schuldtiana → *Adromischus schuldtianus*: 13
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- sempervivum → *Rosularia sempervivum*: 232
- septentrionalis → *Dudleya farinosa*: 94
- serrata → *Rosularia serrata*: 233
- setchellii → *Dudleya setchellii*: 100
- sheldonii → *Dudleya cymosa* ssp. *cymosa*: 93
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- similis → *Tylecodon similis*: 361
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- – var. *spathulata* → *C. orbiculata* var. *oblonga*: 29
- singularis → *Tylecodon singularis*: 361
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- spathulata → *Kalanchoe spathulata*: 176
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- spinosa → *Orostachys spinosa*: 189
- – var. *polystachya* → *Orostachys spinosa*: 189
- sprucei → *Echeveria quitensis* var. *sprucei*: 121
- spuria → *C. orbiculata* var. *spuria*: 30
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- strangulata → *Umbilicus heylandianus*: 365
- striata → *Tylecodon striatus*: 362
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- strictiflora → *Echeveria strictiflora*: 125
- sturmiana → *C. barbeyi*: 28
- subrigida → *Echeveria subrigida*: 126
- subspicata → *Echeveria bicolor*: 107
- – → *Rosularia radicata*: 231
- subulata → *Sedum subulatum*: 322
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- sulphurea → *Tylecodon sulphureus*: 362
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- tenuicaulis → *Rosularia adenotricha* ssp. *adenotricha*: 228
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- transvaalensis → *C. barbeyi*: 28
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- tricuspidata → *C. orbiculata* var. *orbiculata*: 30
- triflora → *Adromischus triflorus*: 14
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- tuberculosa → *Tylecodon grandiflorus*: 357
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- ssp. gaditana → Umbilicus horizontalis var. horizontalis: 366
- horizontalis → Umbilicus horizontalis: 365
- intermedia → Umbilicus horizontalis var. intermedius: 366
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- micrantha → Umbilicus horizontalis: 365
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- pomelii → Umbilicus horizontalis: 366
- praealta → Umbilicus heylandianus: 365
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- vires → Dudleya virens: 102
- virescens → C. orbiculata var. oblonga: 29
- virgata → Villadia virgata: 374
- viridiflora → Tylecodon viridiflorus: 363
- viridis → C. orbiculata var. oblonga: 29
- viscida → Dudleya viscida: 103
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- viscosa → Sedum mucizonia: 295
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- yosemitense → Sedum obtusatum ssp. obtusatum: 300
- zeyheri → Adromischus cristatus var. zeyheri: 10
- zuluensis → C. orbiculata var. oblonga: 29
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- – – **psammophila**: 41
- brevistyla → C. capitella ssp. meyeri: 42
- broomii → C. barbata ssp. broomii: 40
- browniana → C. expansa ssp. fragilis: 52
- bullulata → C. flava: 53
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- caerulata → C. crenulata: 47
- caespitosa → Sedum caespitosum: 250
- caffra → C. sp.: 35
- **campestris**: 41
- – fa. compacta → C. campestris: 41
- – – laxa → C. campestris: 41
- – ssp. pharnaceoides → C. alata ssp. pharnaceoides: 36
- – – rhodesica → C. rhodesica: 71
- canescens → C. nudicaulis var. nudicaulis: 64
- – var. angustifolia → C. nudicaulis var. nudicaulis: 64
- – – latifolia → C. cotyledonis: 46
- **capensis**: 41
- – var. **albertinae**: 41
- – – **capensis**: 42
- – – leipoldtii → C. sp.: 35
- – – **promontorii**: 42
- capillacea → C. filiformis: 53
- capitata → C. fascicularis: 52
- – → C. subulata var. subulata: 78
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- – – enantiophylla → C. capitella ssp. nodulosa: 42
- – – **meyeri**: 42
- – – **nodulosa**: 42
- – – **sessilicymula**: 42
- – – **thyrsoflora**: 43
- capitellata → C. capitella ssp. capitella: 42
- caudiculata → C. peduncularis: 67
- centauroides → C. strigosa: 77
- cephalophora → C. nudicaulis var. nudicaulis: 64
- – var. basutica → C. nudicaulis var. nudicaulis: 64
- – – dubia → C. cotyledonis: 46
- – – tayloriae → C. cotyledonis: 46
- – – thunbergii → C. nudicaulis var. nudicaulis: 64

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- chloraeflora → C. dichotoma: 49
- **ciliata**: 43
- var. acutifolia → C. vaginata ssp. vaginata: 82
- cinerea → C. atropurpurea var. cultriformis: 39
- **clavata**: 43
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- var. muirii → C. atropurpurea var. rubella: 39
- marginata → C. atropurpurea var. atropurpurea: 38
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- cogmansensis → C. subaphylla var. subaphylla: 78
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- commutata → C. rupestris ssp. commutata: 72
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- connivens → C. tetragona ssp. connivens: 80
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- cooperi → C. exilis ssp. cooperi: 51
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- var. cordata → C. capitella ssp. thyrsoflora: 43

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- major → C. capitella ssp. thyrsoflora: 43
- typica → C. capitella ssp. thyrsoflora: 43
- cotyledon → C. arborescens ssp. arborescens: 38
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- **cotyledonis**: 46
- crassiflora → C. vaginata ssp. vaginata: 82
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- **cultrata**: 47
- var. typica → C. cultrata: 47
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- ssp. robusta → C. atropurpurea var. cultriformis: 39
- curta → C. setulosa var. rubra: 75
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- cyclophylla → C. spathulata: 77
- cylindrica → C. pyramidalis: 70
- **cymbiformis**: 47
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- dasyphylla → C. corallina ssp. corallina: 46
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- densa → C. elegans ssp. elegans: 50
- densifolia → C. tetragona ssp. tetragona: 81
- **dentata**: 49
- var. minor → C. dentata: 49
- **dependens**: 49
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- dewinteri → C. pubescens ssp. pubescens: 70
- diabolica → C. pellucida ssp. brachypetala: 67
- diaphana → C. strigosa: 77
- **dichotoma**: 49
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- diffusa → C. kirkii: 56
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- dinteri → C. elegans ssp. elegans: 50
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- **dodii**: 50
- drakensbergensis → C. vaginata ssp. vaginata: 82
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- dregei → C. pellucida ssp. brachypetala: 67

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- dubia → C. cotyledonis: 46
- eendornensis → C. tomentosa var. glabrifolia: 81
- elata → C. capitella ssp. nodulosa: 42
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- **elegans**: 50
- – ssp. **elegans**: 50
- – – **namibensis**: 50
- ellenbeckiana → C. alba: 36
- elongata → C. pellucida ssp. brachypetala: 67
- **elsiae**: 50
- enantiophylla → C. capitella ssp. nodulosa: 42
- engleri → C. montana ssp. montana: 60
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- – var. longifolia → C. expansa ssp. expansa: 51
- **exserta**: 52
- falcata → C. perfoliata var. minor: 68
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- fergusoniae → C. pubescens ssp. pubescens: 70
- – fa. major → C. pubescens ssp. pubescens: 70
- filamentosa → C. lanceolata ssp. lanceolata: 57
- filicaulis → C. expansa ssp. filicaulis: 51
- **filiformis**: 53
- flabellifolia → C. umbella: 82
- **flanaganii**: 53
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- flavovirens → C. brevifolia ssp. brevifolia: 41
- fragilis → C. expansa ssp. fragilis: 52
- – → C. pubescens ssp. pubescens: 70
- – var. suborbicularis → C. expansa ssp. fragilis: 52
- fragillima → C. brevifolia ssp. brevifolia: 41
- fruticulosa → C. sp.: 35
- furcata → C. ericoides ssp. ericoides: 51
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- gifbergensis → C. atropurpurea var. watermeyerii: 39
- gillii → C. montana ssp. quadrangularis: 60
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- glauca → C. cordata: 46
- globifera → C. capensis var. capensis: 42
- globosa → C. elegans ssp. elegans: 50
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- – fa. globularioides → C. globularioides ssp. globularioides: 54
- – – longiciliata → C. globularioides ssp. globularioides: 54
- – – pilosa → C. globularioides ssp. globularioides: 54
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- – – recurva → C. capitella ssp. capitella: 42
- – – typica → C. hemisphaerica: 55
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- heterotricha → C. perfoliata var. heterotricha: 68
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- – var. dyeri → C. nudicaulis var. nudicaulis: 64
- **hirtipes**: 55
- hispida → C. mesembryanthoides ssp. hispida: 59
- – → C. subulata var. hispida: 78
- hofmeyeriana → C. ausensis ssp. ausensis: 39
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- - - → C. schmidtii: 74
- inaequalis → C. acinaciformis: 35
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- - - var. glabrifolia → C. tomentosa var. glabrifolia: 81
- intricata → C. colorata var. colorata: 44
- involucrata → C. pellucida ssp. brachypetala: 67
- jacobseniana → C. ericoides ssp. ericoides: 51
- jasminea → C. obtusa: 65
- jenkinsii → C. setulosa var. jenkinsii: 75
- johannis-winkleri → C. perfoliata var. coccinea: 68
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- karasana → C. ausensis ssp. ausensis: 39
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- lambertiana → C. oblanceolata: 65
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- laticephala → C. congesta ssp. laticephala: 45
- latispathulata → C. spathulata: 77
- laxa → C. dependens: 49
- leachii: 58
- leipoldtii → C. decumbens var. decumbens: 48
- lettyae → C. barbata ssp. barbata: 40
- leucantha → C. multiflora ssp. leucantha: 61
- levynsiae → C. natans var. natans: 64
- liebuschiana → C. globularioides ssp. globularioides: 54
- lignosa → C. sarcocaulis ssp. sarcocaulis: 72
- limosa → C. papillosa: 66
- lineolata → C. pellucida ssp. marginalis: 67
- - - fa. gracilis → C. pellucida ssp. brachypetala: 67
- - - magna → C. pellucida ssp. brachypetala: 67
- - - natalensis → C. pellucida ssp. brachypetala: 67

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- - - var. petiolata → C. pellucida ssp. brachypetala: 67
- - - pilosa → C. tomentosa var. tomentosa: 81
- linguifolia → C. tomentosa var. tomentosa: 81
- liquiritiodora → C. elegans ssp. elegans: 50
- littlewoodii → C. ausensis ssp. ausensis: 39
- littoralis → C. muscosa var. muscosa: 62
- loganiana → C. subaphylla var. subaphylla: 78
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- longistyla → C. obovata var. dregeana: 65
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- - - [?] variegata → C. muscosa var. muscosa: 62
- - - fa. acuminata → C. muscosa var. muscosa: 62
- - - fragilis → C. muscosa var. muscosa: 62
- - - fulva → C. muscosa var. muscosa: 62
- - - purpusii → C. muscosa var. muscosa: 62
- - - var. obtusifolia → C. muscosa var. obtusifolia: 62
- - - polpodacea → C. muscosa var. polpodacea: 62
- - - pseudolycopodioides → C. muscosa var. muscosa: 62
- macbridei → C. closiana: 43
- macowaniana: 58
- - - var. crassifolia → C. macowaniana: 58
- macowanii → C. tetragona ssp. acutifolia: 80
- macrantha → C. decumbens var. decumbens: 48
- - - var. nuda → C. decumbens var. decumbens: 48
- magellanica → C. moschata: 60
- magnolii → Sedum caespitosum: 250
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- mannii → C. vaginata ssp. vaginata: 82
- maputensis → C. expansa ssp. expansa: 51
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- margaritifera → C. mollis: 60
- marginalis → C. pellucida ssp. marginalis: 67
- marginata → C. pellucida ssp. pellucida: 67
- mariae → C. sp.: 35
- maritima → C. expansa ssp. filicaulis: 51
- marlothii → C. dentata: 49
- marnieriana → C. rupestris ssp. marnieriana: 72
- massonii → C. alpestris ssp. massonii: 37
- massonoides → C. compacta: 45
- mataikona: 59
- media → C. fascicularis: 52
- merxmülleri → C. sericea var. hottentotta: 74
- mesembrianthemopsis: 59
- mesembrianthoides → C. elegans ssp. elegans: 50
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- – – **mesembryanthoides**: 59
- meyeri → C. capitella ssp. meyeri: 42
- **micans**: 59
- micrantha → C. atropurpurea var. atropurpurea: 38
- microcarpa → Sedum microcarpum: 292
- microsquamata → C. dejecta: 48
- milfordiae → C. setulosa var. rubra: 75
- milleriana → C. alba var. alba: 36
- minima → C. connata: 45
- – → C. dentata: 49
- **minuta**: 59
- minutiflora → C. thunbergiana ssp. minutiflora: 81
- **minutissima**: 60
- miriamiae → C. colorata var. miriamiae: 44
- mitrata → C. columnaris ssp. columnaris: 44
- **mollis**: 60
- mongolica → C. decumbens var. decumbens: 48
- **montana**: 60
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- – – **quadrangularis**: 60
- monticola → C. rupestris ssp. rupestris: 72
- montis-draconis → C. brevifolia ssp. brevifolia: 41
- montis-moltkei → C. dependens: 49
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- **moschata**: 60
- mossii → C. compacta: 45
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- – var. mossii → C. capitella ssp. meyeri: 42
- **natans**: 63
- – fa. amphibia → C. natans var. natans: 64
- – – filiformis → C. natans var. minus: 63
- – – fluitans → C. natans var. natans: 63
- – – obovata → C. natans var. natans: 64
- – – parvifolia → C. natans var. natans: 64
- – ssp. filiformis → C. natans var. minus: 63
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- – – **minus**: 63
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- nealeana → C. perforata: 68
- neglecta → C. cordata: 46
- **nemorosa**: 64
- nitida → C. ovata: 66
- nivalis → C. nemorosa: 64
- nodulosa → C. capitella ssp. nodulosa: 42
- – fa. rhodesica → C. capitella ssp. nodulosa: 42
- – var. longispala → C. capitella ssp. nodulosa: 42
- nuda → C. capitella ssp. thyrsoflora: 43
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- – var. glabra → C. nudicaulis var. nudicaulis: 64
- – – **herrei**: 64
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- **numaisensis**: 65
- nummulariifolia → C. pellucida ssp. alsinoides: 67
- nyikensis → C. globularioides ssp. globularioides: 54
- **oblanceolata**: 65
- obliqua → C. atropurpurea var. atropurpurea: 38
- – → C. ovata: 66
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- **obtusa**: 65
- obvallata → C. nudicaulis var. nudicaulis: 64
- odoratissima → C. fascicularis: 52
- **orbicularis**: 65
- otzenii → C. grisea : 55
- ovallei → C. decumbens var. decumbens: 48
- **ovata**: 66
- – → C. sarmentosa var. sarmentosa: 73
- pachyphylla → C. congesta ssp. congesta: 45
- pachystemon → C. lanuginosa var. pachystemon: 58
- **pageae**: 66
- **pallens**: 66
- pallida → C. perfoliata var. perfoliata: 68
- paludosa → C. peduncularis: 67
- paniculata → C. capitella ssp. capitella: 42
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- parvifolia → C. schimperi ssp. phyturus: 73
- parvipetala → C. tenuipedicellata: 79
- parvisepala → C. sarcocaulis ssp. sarcocaulis: 72
- parvula → C. muscosa var. parvula: 62
- patens → C. dentata: 49
- patersoniae → C. perforata: 68
- pearsonii → C. brevifolia ssp. brevifolia: 41
- pectinata → C. capitella ssp. nodulosa: 42
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- pedicellosa → C. closiana: 43
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- pentandra → C. schimperi ssp. schimperi: 73
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- – obtusifolia → C. schimperi ssp. phyturus: 73
- – phyturus → C. schimperi ssp. phyturus: 73
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- **perfoliata**: 68
 - var. albiflora → C. perfoliata var. perfoliata: 68
- – **coccinea**: 68
- – falcata → C. perfoliata var. minor: 68
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- petrogeton → C. dentata: 49
- pharnaceoides → C. alata ssp. pharnaceoides: 36
- ssp. eu-pharnaceoides → C. alata ssp. pharnaceoides: 36
- – rhodesica → C. rhodesica: 71
- **phascoides**: 69
- phyturus → C. schimperi ssp. phyturus: 73
- picturata → C. exilis ssp. cooperi: 51
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- platyphylla → C. nudicaulis var. platyphylla: 64
- **plegmatoides**: 69
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- portulacea → C. ovata: 66
- procumbens → C. sp.: 35
- profusa → C. pellucida ssp. marginalis: 67
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b *Adromischus hemisphaericus*



c *Adromischus leucophyllus*



d *Adromischus maximus*



e *Adromischus trigynus*



f *Adromischus roanianus*



g *Adromischus roanianus*



a *Aeonium aizoon*



b *Aeonium arboreum* var. *holochrysum*



c *Aeonium aureum*



d *Aeonium canariense* var. *canariense*



e *Aeonium davidbramwellii*



f *Aeonium dodrantale*



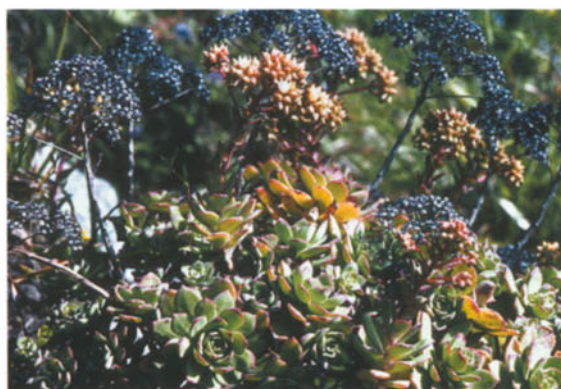
g *Aeonium glandulosum*



h *Aeonium glutinosum*



a *Aeonium arboreum* var. *rubrolineatum*



b *Aeonium haworthii*



c *Aeonium hierrense*



d *Aeonium lindleyi* var. *lindleyi*



e *Aeonium nobile*



f *Aeonium spathulatum*



g *Afrovivella semiensis*



a *Aichryson laxum*



b *Aichryson parlatorei*



c *Aichryson pachycaulon*



d *Cotyledon woodii*



e *Cotyledon orbiculata* var. *orbiculata*



f *Cotyledon papillaris*



a *Crassula ausensis* ssp. *ausensis*



b *Crassula atropurpurea* var. *watermeyerii*



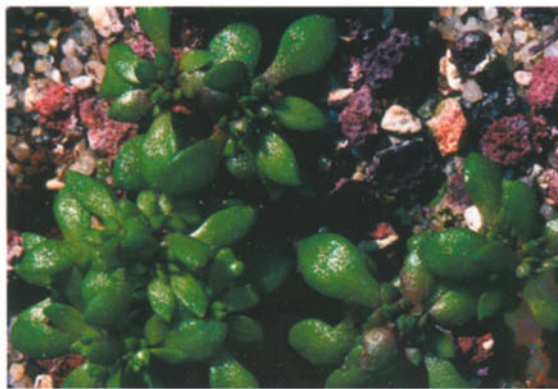
c *Crassula brevifolia* ssp. *brevifolia*



d *Crassula capitella* ssp. *thyrsoiflora*



e *Crassula ciliata*



f *Crassula closiana*



g *Crassula coccinea*

a *Crassula deceptor*b *Crassula columella*c *Crassula connata*d *Crassula cultrata*e *Crassula dejecta*f *Crassula deltoidea*g *Crassula dichotoma*



a *Crassula ericoides* ssp. *ericoides*



b *Crassula expansa* ssp. *expansa*



c *Crassula fascicularis*



d *Crassula expansa* ssp. *fragilis*



e *Crassula hemisphaerica*



f *Crassula hirtipes*



g *Crassula humbertii*



h *Crassula lanceolata* ssp. *denticulata*



a *Crassula lanceolata* ssp. *transvaalensis*



b *Crassula tetragona* ssp. *acutifolia*



c *Crassula montana* ssp. *montana*



d *Crassula multiceps*



e *Crassula natans* var. *natans*



f *Crassula orbicularis*



g *Crassula ovata*



h *Crassula peploides*



a *Crassula sarcocaulis* ssp. *rupicola*



b *Crassula perfoliata* var. *perfoliata*



c *Crassula pubescens* ssp. *pubescens*



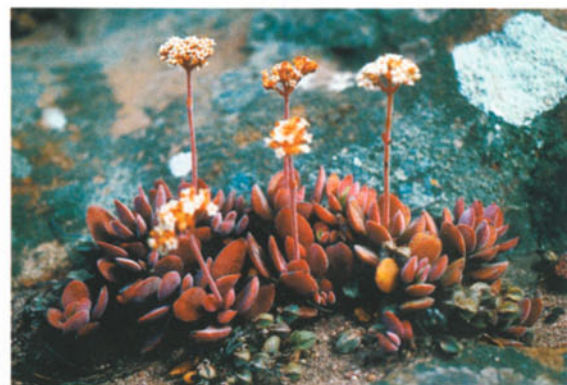
d *Crassula rupestris* ssp. *rupestris*



e *Crassula sarcocaulis* ssp. *rupicola*



f *Crassula susannae*



g *Crassula swaziensis*

a *Crassula pseudohemisphaerica*b *Crassula sieberiana* ssp. *sieberiana*c *Crassula subaphylla* var. *subaphylla*d *Crassula tomentosa* var. *glabrifolia*e *Crassula umbella*f *Crassula cremnophila*g *Cremnophila linguifolia*h *Cremnophila nutans*



M. Kimmach

a *Cremnophila nutans*



J. Traeger

b *Dudleya brittonii*



J. Traeger

c *Dudleya cymosa* ssp. *cymosa*



J. Traeger

d *Dudleya multicaulis*



J. Traeger

e *Dudleya nubigena* ssp. *nubigena*



J. Traeger

f *Dudleya virens* ssp. *virens*



J. Elter & M. Krimm

g *Dudleya farinosa*



U. Eggli

h *Dudleya pulverulenta* ssp. *arizonica*

a *Echeveria agavoides* 'Corderoyi'b *Echeveria bicolor* var. *bicolor*c *Echeveria coccinea*d *Echeveria harmsii*e *Echeveria longissima* var. *azatlensis*f *Echeveria lutea*g *Echeveria craigiana*h *Echeveria longissima* var. *longissima*



a *Echeveria derenbergii*



b *Echeveria cante*



c *Echeveria humilis*



d *Echeveria heterosepala*



e *Echeveria lilacina*



f *Echeveria laui*



g *Echeveria nodulosa*



h *Echeveria prolifica*

a *Echeveria johnsonii*b *Echeveria megacalyx*c *Echeveria minima*d *Echeveria moranii*e *Echeveria quitensis* var. *quitensis*f *Echeveria quitensis* var. *sprucei*g *Echeveria setosa* var. *diminuta*h *Echeveria simulans*



a *Echeveria setosa* var. *setosa*



b *Echeveria skinneri*



c *Echeveria spectabilis*



d *Echeveria peacockii*



e *Echeveria tolimanensis*



f *Echeveria walpoleana*



g *Echeveria subalpina*



h *Echeveria subcorymbosa*



a *Graptopetalum amethystinum*



b *Graptopetalum bellum*



c *Graptopetalum fruticosum*



d *Graptopetalum filiferum*



e *Graptopetalum macdougallii*



f *Graptopetalum pentandrum* ssp. *pentandrum*



a *Graptopetalum grande*



b *Graptopetalum pentandrum* ssp. *superbum*



c *Graptopetalum rusbyi*



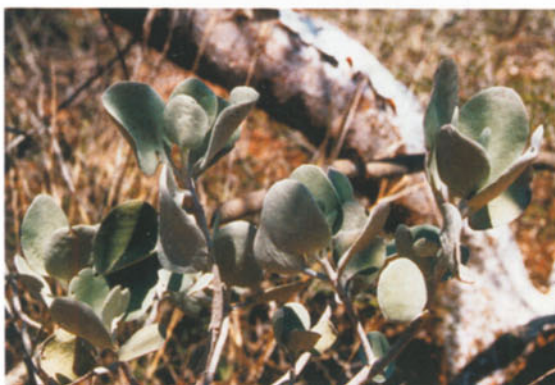
d *Hylotelephium spectabile*



e *Hylotelephium verticillatum* var. *verticillatum*



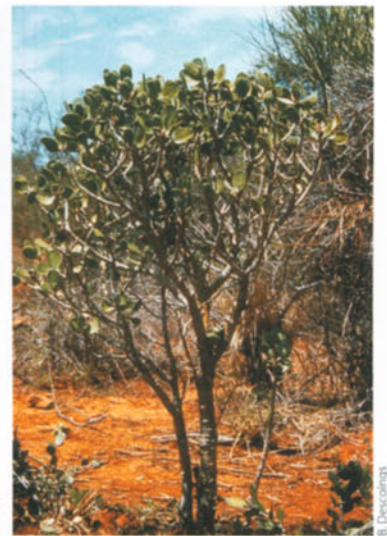
f *Kalanchoe beharensis*



g *Kalanchoe bracteata*



h *Kalanchoe beharensis*

a *Kalanchoe bracteata*b *Kalanchoe delagoensis*c *Kalanchoe dinklagei*d *Kalanchoe farinacea*e *Kalanchoe fadeniurum*f *Kalanchoe fedtschenkoi*g *Kalanchoe beauverdii*h *Kalanchoe gracilipes*



a *Kalanchoe gastonis-bonnieri*



b *Kalanchoe hildebrandtii*



c *Kalanchoe linearifolia*



d *Kalanchoe manginii*



e *Kalanchoe marmorata*



f *Kalanchoe marnieriana*



g *Kalanchoe jongmansii* ssp. *jongmansii*



h *Kalanchoe laetivirens*



a *Kalanchoe miniata*



b *Kalanchoe nyikae* ssp. *nyikae*



c *Kalanchoe orgyalis*



d *Kalanchoe pinnata*



e *Kalanchoe porphyrocalyx*



f *Kalanchoe rhombopilosa*



a *Kalanchoe miniata*



b *Kalanchoe migiurtinorum*



c *Kalanchoe prolifera*



d *Kalanchoe pubescens*



e *Kalanchoe pumila*



f *Kalanchoe robusta*



g *Kalanchoe synyepala*



h *Kalanchoe tomentosa*



a *Kalanchoe uniflora*



b *Lenophyllum latum*



c *Kalanchoe tetraphylla*



d *Kalanchoe thyrsiflora*



e *Kalanchoe viguieri*



f *Lenophyllum guttatum*



g *Lenophyllum latum*



h *Lenophyllum texanum*



a *Monanthes icterica*



b *Monanthes icterica*



c *Monanthes laxiflora*



d *Monanthes minima*



e *Monanthes muralis*



f *Monanthes muralis*



g *Monanthes pallens*



h *Monanthes polyphylla* ssp. *polyphylla*

a *Orostachys japonica*b *Orostachys thyrsiflora*c *Pachyphytum coeruleum*d *Pachyphytum compactum*e *Pachyphytum glutinicaule*f *Pachyphytum kimnachii*g *Pachyphytum fittkaui*h *Pachyphytum werdermannii*



a *Pachyphytum oviferum*



b *Pachyphytum werdermannii*



c *Phedimus kamtschaticus*



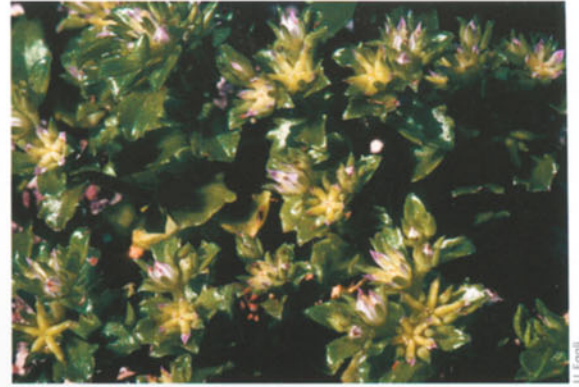
d *Phedimus spurius*



e *Phedimus kamtschaticus*



a *Prometheum sempervivoides*



b *Phedimus stellatus*



c *Prometheum sempervivoides*



d *Prometheum chrysanthum*



e *Prometheum aizoon*



f *Prometheum muratdagense*



a *Prometheum serpenticum* var. *serpenticum*



b *Prometheum pilosum*



c *Prometheum tymphaeum*



d *Rhodiola alsia* ssp. *alsia*



e *Rhodiola coccinea* ssp. *coccinea*



f *Rhodiola crenulata*



g *Rhodiola crenulata*



a *Rhodiola discolor*



b *Rhodiola chrysanthemifolia* ssp. *chrysanthemifolia*



c *Rhodiola cretinii* ssp. *cretinii*



d *Rhodiola fastigiata*



e *Rhodiola heterodonta*



f *Rhodiola himalensis* ssp. *himalensis*



g *Rhodiola himalensis* ssp. *himalensis*



a *Rhodiola hookeri*



b *Rhodiola kirilowii*



c *Rhodiola macrocarpa*



d *Rhodiola kirilowii*



e *Rhodiola hobsonii*



a *Rhodiola primuloides* ssp. *primuloides*



b *Rhodiola rosea*



c *Rhodiola tibetica*



d *Rosularia alpestris* ssp. *marnieri*



e *Rhodiola wallichiana*



f *Rosularia adenotricha* ssp. *adenotricha*



a *Rosularia globulariifolia*



b *Rosularia lineata*



c *Rosularia platyphylla*



d *Rosularia serrata*



e *Rosularia sempervivum* ssp. *glaucophylla*



f *Rosularia sempervivum* ssp. *persica*



a *Sedum alsinefolium*



b *Sedum alamosanum*



c *Sedum alpestre*



d *Sedum allantoides*



e *Sedum alexanderi*



f *Sedum alexanderi*



a *Sedum aytacianum*



b *Sedum burrito*



c *Sedum chloropetalum*



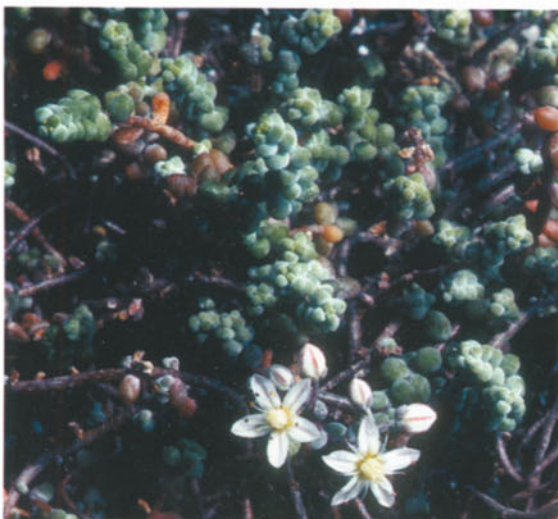
d *Sedum caeruleum*



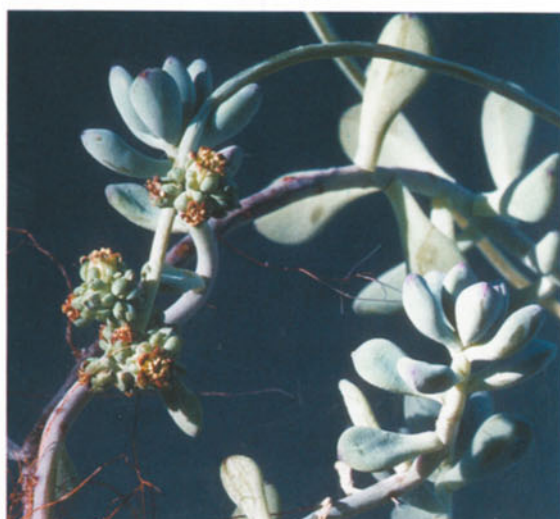
e *Sedum cockerellii*



f *Sedum cyprium*



g *Sedum brevifolium*



h *Sedum commixtum*



a *Sedum compressum*



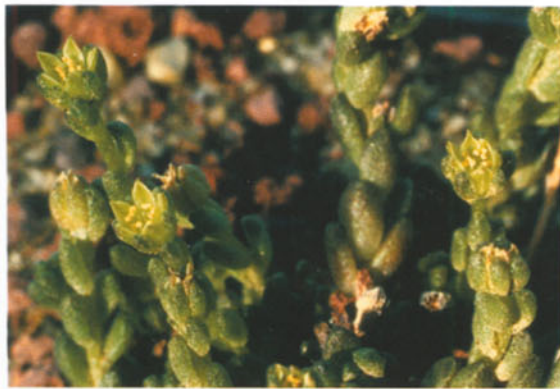
b *Sedum corynephyllum*



c *Sedum craigii*



d *Sedum cupressoides*



e *Sedum cymatopetalum*



f *Sedum dasphyllum* var. *dasphyllum*



g *Sedum hirsutum* ssp. *hirsutum*



h *Sedum jaccardianum*



a *Sedum dendroideum* ssp. *dendroideum*



b *Sedum dendroideum* ssp. *praealtum*



c *Sedum ebracteatum* ssp. *ebracteatum*



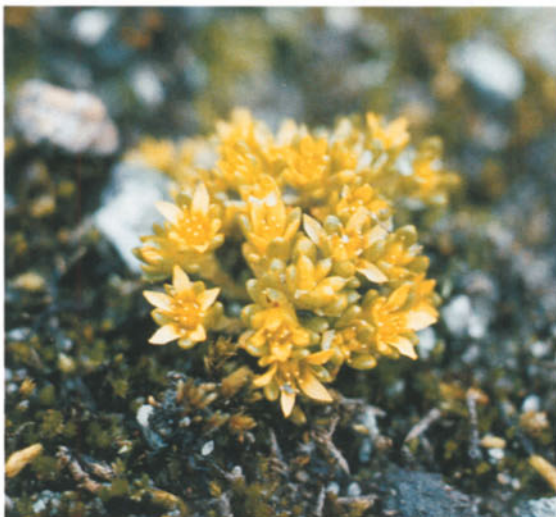
d *Sedum frutescens*



e *Sedum gracile*



f *Sedum hakonense*



g *Sedum henrici-robertii*



h *Sedum hernandezii*

a *Sedum lampusae*b *Sedum hintonii*c *Sedum hispanicum*d *Sedum laconicum*e *Sedum lancerottense*f *Sedum lineare*g *Sedum longipes* ssp. *longipes*



a *Sedum macdougalii*



b *Sedum lucidum*



c *Sedum mellitulum*



d *Sedum morganianum*



e *Sedum moranense* ssp. *moranense*



f *Sedum mucizonia*

a *Sedum obtusatum* ssp. *boreale*b *Sedum multiceps*c *Sedum muscoideum*d *Sedum nussbaumerianum*e *Sedum oaxacanum*f *Sedum obcordatum*g *Sedum oreades*



a *Sedum pachyphyllum*



b *Sedum palmeri*



c *Sedum rupestre* ssp. *rupestre*



d *Sedum reptans*



e *Sedum edwardsii*



f *Sedum rubens*



g *Sedum oxypetalum*



h *Sedum robertsianum*

a *Sedum rubrotinctum*b *Sedum spathulifolium* ssp. *pruinatum*c *Sedum stenopetalum* ssp. *stenopetalum*d *Sedum subtile* ssp. *subtile*e *Sedum tenellum*f *Sedum triactina* ssp. *triactina*g *Sedum tristriatum*h *Sedum sexangulare*



a *Sedum versadense* var. *villadioides*



b *Sedum trullipetalum* var. *trullipetalum*



c *Sedum uniflorum* ssp. *japonicum*



d *Sedum versadense* var. *versadense*



e *Sedum urvillei*



f *Sedum villosum*



g *Sedum vinicolor*

a *Sempervivum davisii*b *Sempervivum arachnoideum* ssp. *arachnoideum*c *Sempervivum artvinense*d *Sempervivum davisii*e *Sempervivum caucasicum*f *Sempervivum furseorum*g *Sempervivum grandiflorum*



a *Sempervivum tectorum* var. *tectorum*



b *Sempervivum tectorum* var. *tectorum*



c *Sempervivum montanum* ssp. *montanum*



d *Sempervivum wulfenii* ssp. *wulfenii*



e *Sempervivum montanum* ssp. *montanum*



f *Sempervivum wulfenii* ssp. *wulfenii*



a *Sinocrassula densirosulata*



b *Sinocrassula indica* var. *indica*



c *Thompsonella colliculosa*



d *Thompsonella platyphylla*



e *Thompsonella minutiflora*



f *Thompsonella spatulata*



a *Tylecodon fragilis*



b *Tylecodon bayeri*



c *Tylecodon buchholzianus*



d *Tylecodon occultans*



e *Tylecodon occultans*



f *Tylecodon paniculatus*



a *Tylecodon reticulatus* ssp. *phyllopodium*



b *Tylecodon racemosus*



c *Tylecodon reticulatus* ssp. *reticulatus*



d *Tylecodon pygmaeus*



e *Tylecodon scandens*



f *Tylecodon schaeferianus*



a *Tylecodon similis*



b *Tylecodon sulphureus* var. *armianus*



c *Tylecodon torulosus*



d *Tylecodon rubrovenosus*



e *Tylecodon ventricosus*



f *Tylecodon viridiflorus*



a *Umbilicus oppositifolius*



b *Umbilicus tropaeolifolius*



c *Umbilicus chloranthus*



d *Umbilicus horizontalis* var. *horizontalis*



e *Umbilicus rupestris*



f *Villadia guatemalensis*



g *Villadia guatemalensis*



h *Villadia albiflora*